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ade at Mohamera; and the French Religieuses were crushed into the earth as they stood with their priest and their scholars at morning prayer in their hospital. I left one day afterwards; but even then some fifty people were asserted to have been killed or severely maimed, and it was assumed that some fifty more were missing on the one island of Mahi. The little schooners were crunched together and sunk.

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XIX.—*Explorations in North-Western Australia.*

By JAMES MARTIN, Esq., M.B.

Communicated by the Governor of Western Australia, through the COLONIAL OFFICE.

I. Mr. MARTIN'S *Journal of the First Voyage, 1863.\**

FROM DOUBTFUL BAY TO THE LOWER RAPIDS OF THE GLENELG RIVER.

June 22, 1863.—Doubtful Bay is a magnificent sheet of water, 9 miles in length from north to south, and six miles in breadth from east to west. Although in the summer vast quantities of water may from all sides pour into the bay, and the tides gain additional force thereby, yet, as it is thoroughly protected from every wind and from a heavy sea by a range of islands and reefs to seaward, and the natural break-water of the Montgomery Islands and the coral reef, 14 miles still further to the westward, as the holding ground is of the very best, and as there is abundance of room in which to work the largest ship, Doubtful Bay, if ever this part of the Australian coast should be colonised, will prove a harbour of refuge second to none. From the great rise and fall of the tide also, 36 feet, this bay would be a good site for works necessary to the repairing of ships. A better terminus to the system of Australian telegraphs, when connected with those of Europe and Asia, I think it will be difficult to find. There does not seem to be any agricultural or even pastoral land in the immediate vicinity of the bay, and the hills both of the islands and the main are of the most precipitous character. The south-east shore is fringed with an immense mangrove swamp, intersected by numerous deep creeks. It has all the appearance of being the mouth of a large river.

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\* This part of the memoir is a portion of the narrative of an expedition sent out, with live stock, from Western Australia, in search of new pastoral land in the vicinity of Glenelg River (Lat.  $15^{\circ} 40' S.$ ). The exploring party consisted of three gentlemen (besides Mr. Martin), and sailed from Champion Bay ( $20^{\circ} 45' S.$  lat.) in the schooner *Flying Foam*, on the 6th of June, 1863.

About the centre of this mangrove swamp, on its western limit, rises the Conical Hill we had in line with the centre of "Foam Passage" when we entered the bay last night. It is a remarkable hill rising abruptly from among the mangroves, of a deep red colour, and without any other hill or land visible from our anchorage, nearer than two miles. I believe it to be of the old red sandstone formation, as are the islands to the westward of the bay. Wood and water are obtainable in Doubtful Bay. The old red sandstone here exhibits a great variety of the most picturesque scenery. Outside the bay, in the islands, it attains its grandest development, wrapping round older rocks and effectually protecting them from the action of the tides and current. The rock is a conglomerate of fine hard gravel of a dark red colour. The character of the old sandstone, and the way in which it is broken and worn away to form picturesque cliffs, is also well illustrated in the smaller islands to the south of the entrance to Doubtful Bay. A bold headland is here nearly separated from the principal island by the action of the waves, which have already worn away deep cavities beneath, and threaten soon to complete the destruction they have begun. The dark, frowning, and gloomy masses of rock are piled over one another in an order not irregular, and the huge step-like terraces, by which one may descend nearly to the line of high water, afford admirable instances of stratification, joints, and faults. The larger of the rugged, isolated, projecting fragments in the island, taken as a type of the whole group, is from 100 to 120 feet in height, and about the same in breadth and thickness.

At 8.45 A.M., a party consisting of three of the explorers, with one servant, and the master of the vessel, left in the long boat to climb the range eastward of the bay to search for a navigable entrance to the Glenelg. Fires, in groups of two, sprang up from the sea-beach, where the party landed, to the summit of the first range ;—they are doubtlessly native signal fires. At noon the tide was running into the bay at the rate of four knots per hour. A great many more fires are now springing up in all directions. At 3 P.M. a signal was made from the shore, upon which we got under weigh. About a mile and a half from our anchorage we met the party in the long boat. They report a rugged country without soil, but with trees and coarse grass growing luxuriantly. the latter was nearly three feet in height. Among the trees seen were—eucalypti, acaciæ, adansoniæ, palms, and a tree whose leaf, as to venation and other features, closely resembled the camellia. The walk was so fatiguing that the ascent to the highest point of the range was not accomplished. The natives seemed very numerous, judging by their fires and cooeeing, but they kept out of sight at first ; indeed, a near view of one individual only was obtained.

This native carried a bundle of unusually long spears. Before the party rejoined the boat, however, several were seen in the distance, as if watching the behaviour of their unlooked for visitors. From the set of the tide, which seemed to come from the north-eastern of the two supposed mouths of the Glenelg, as laid down upon Grey's chart, we determined to examine it more closely. At 4 P.M., although the tide was just commencing to run out, the wind was sufficiently strong to carry us about  $2\frac{1}{2}$  miles up the supposed river, to a point on the western shore, where a few detached rocks to the northward protected us from the force of the tide. We anchored in 10 fathoms water at about 50 yards from a rocky precipitous shore, about 30 minutes after sundown. At one mile from the entrance of this passage, on the eastern shore, there was a broad water-course, with mangrove swamps on either side, trending from east by south.

*June 23.*—Before breakfast a party went on shore, and in an hour returned with numerous specimens of the flora, together with geological and other specimens. Of the geological collection, by far the most interesting were the basaltic fragments. At 9 A.M. the tide was ebbing rapidly. After breakfast another boating party returned with many specimens of coral and sponge alive, obtained from just below low-water line; also a trochus and triton, both of which I believe to be undescribed species; rock-oysters were found adhering in large clumps to the rocks and to each other, but they were of small size. At a quarter past 10 A.M., we fired a gun as a signal to the land party, who forthwith came on board, just as the anchor was weighed at the commencement of flood-tide. The passage here is little more than half a mile wide. About two miles to the north of our anchorage a reef of rocks came out into mid-stream. Through the passage, in soundings of from 8 to 17 fathoms, the tide was now rushing with immense velocity; at one time it took three men at the tiller to keep the vessel under command. Sailing through this critical pass, not more than a quarter of a mile in width, the stream opened to a wide expanse of water about 6 miles in breadth, from east to west, with an apparently clear extent to north of about 9 miles. There seems to be an opening to seaward on the south-west boundary. This splendid sheet of water we propose to name George Water: there was barely a ripple upon its surface, and during the afternoon we were sailing gently through with a scarcely perceptible tide, at a rate varying from two to three knots, and in soundings exceeding 15 fathoms. On our passage we observed dolphins, seals (*Phocena vulgaris* and *Leptonyx weddelli*), and many aquatic snakes (both *hydrophides* and *hydri*). At 3.30 P.M. the water shoaled rapidly to six fathoms; the vessel was put about immediately, and we then anchored in east longitude  $124^{\circ} 39' 15''$ , and south latitude

15° 45' 40". Before us stretched a long line of mangroves with several openings : one of the latter a little westward of our course. As soon as possible after coming to anchor, the boat party, as yesterday, left with provisions and equipment, for 24 hours, to search for a navigable passage to that portion of the river which had been seen by Grey ; from which point we cannot now be distant more than ten miles in a straight line. The force of the tide, strange to say, is not much diminished here ; further observations may, perhaps, show the reason why. At 8 P.M. the boat party returned ; they had found the passage N.N.W. of our anchorage to be navigable, with a muddy bottom, and boundaries on either side of mangrove banks. At a distance of about four miles from the vessel, the water-course divided at the base of a round hill, up which our explorers climbed a part of the way ; but night coming on, they returned to the vessel.

June 24.—At 9.25 A.M., the boat party again left to search for an opening to the eastward of the mangrove bank. The stream immediately before us has a mud bar, dry at low water, but, from soundings taken last night, with more than a sufficient depth of water on it at high water ; inside the bar the soundings exceed 15 fathoms. An ibis, resembling the *ibis religiosa*, or white ibis, was seen on the mud bar, but beyond the range of our guns. A curious marine creature of the order *Errantia*, family *Eunicidae*, was this day captured alongside the vessel. It may be described as an elongated and distinctly annulated worm, possessing a well developed head, furnished with tentacles and eyes, and a mouth with an armed proboscis. The branchial tufts were developed only slightly. At 1 P.M., the boat party returned unsuccessful as to their search for a navigable opening ; so, half-an-hour afterwards, we weighed anchor and crossed the mud bar in from 3 to 4 fathoms water ; an hour and a half after this the ebb-tide commenced, and we cast anchor in 6 fathoms water about a mile south of the confluence of the two broad streams immediately before us. Two parties then made preparation to start directly to examine the two streams. One of them, with the master of the vessel and one man, went in the long boat, and undertook the exploring of the western stream ; the other, taking the gig, pulled up the eastern. I belonged to the long-boat party ; we thoroughly examined our water-course and its tributaries, but we found that all the creeks terminated in tangled mangroves, through which the boat could not pass. At the junction on the return trip, we met the party in the gig, equally unsuccessful : mangroves baffling all in their attempts to get through. The head of the broad sheet of water we entered yesterday, so far as we have examined it, consists of numerous islands, having in many cases their surfaces some distance below high-water mark. The creeks which intersect these low mud

islands are deep—from 6 to 17 fathoms—with steep sides covered with a dense growth of at least five species of mangrove. At the head of one of these creeks the water was only brackish at high water; this fact, coupled with the appearance of flocks of cockatoos and pigeons, argues the presence of fresh water at no great distance from our anchorage. A white crested eagle-hawk was this evening shot, whilst perched upon our topsail yard. Another white crested hawk, with wings of a rich chocolate brown, the extremities of the feathers darkening to almost black, was shot, whilst perched upon a mangrove; this I believe to be an undescribed species; I have therefore spared time to preserve the skin and skull. The aquila fucosa we have seen already several times.

*June 25.*—At 4 A.M., two boat parties were dispatched. In the long boat, Mr. Cooper and Mr. A. Brown, with one servant, went to examine a gulley in which we thought we saw a cascade on the 23rd, with a view to discover some convenient spot where we might obtain a sufficient supply (1000 gallons) of fresh water to fill up our tanks; we have only 600 gallons on board now; the stock require a plentiful supply, as the temperature ranges rather high. The shore party in the gig consisted of two of our party, with a man to bring the boat back after they had landed. The shore party were to walk to a high hill, distant about 5 miles, and from its summit to examine the country, and if possible discover water communication with that portion of the Glenelg seen by Grey. The man, after landing the party, was to return to the vessel and then explore the creeks in search of fresh water. The gig returned at 8 A.M., after landing us on a mud-bank where there were tracks of alligators, both large and small. One large creature,—its motion was too rapid to catch more than a glimpse (although from that glimpse I believe it was an alligator),—ran down the mud-bank opposite to which we were anchored, and with a loud splash plunged into deep water. This was about the time of sunrise. I watched some time, hoping to see it again, but in this hope I was disappointed. Parrots, cockatoos, pigeons, and kingfishers, were all most richly coloured; they were very numerous here. Small birds, too, not larger than humming-birds, fluttered about in great numbers.

The morning was occupied in taking observations to determine the exact position of the vessel. Found the longitude to be  $124^{\circ} 39' 12''$  E., and latitude  $15^{\circ} 43' 10''$  s. Found a scarlet-and-black pea in the pod, with leaves but no flowers. Found a half-ripe bean floating past the vessel. The long-boat party returned at 1 P.M. After sailing down the western shore of the broad reach for a short distance they landed at promising spots and looked for water; and although they did not find water, they

collected some highly interesting geological specimens. Finally they landed at the conical red hill, four creeks to the south of the cascade gully;—(this latter, by the way, is no cascade at all—but merely a vein of greenstone, which, glistening in the sun, gave us the effect of falling water when we were about four miles off); but, to continue: the party had landed and were advanced some distance in the muddy bank of the little stream, when they overheard natives among the mangroves. In a few minutes about 20 natives made a bold dash to cut off the party from the boat. A very numerous body were also seen rapidly approaching in an opposite direction, that is from the south. The first body of natives then advanced steadily in line, each with a spear shipped in a woomera (throwing-stick) and a bundle of spears held in the left hand. At 15 paces from our party, who had now covered each his man, the natives were prepared to throw their spears, as was seen by their left hands being lowered from the spear about to be thrown. One of them then stepped in advance, and just as he was in the act of hurling his deadly weapon, the first shot was fired. Although the native fell, the rest still advanced steadily. A second then ran forward: he fell at the firing of the second shot. This made them pause for a moment and then retreat in all haste behind the mangroves. During the retreat, a third charge of shot was fired at one poor fellow in the act of running away; none of the shots proved immediately fatal. A ludicrous incident in the affair happened to the man in charge of the boat. He was in the water endeavouring to prevent the boat grounding when he first saw the natives; he immediately took up the gun left for his protection, and found it was not loaded. He at once loaded it, and then discovered there were no caps left in the boat. The affray commencing, he levelled his uncapped piece and commenced a series of shouts and grimaces that rivalled, if they did not excel, those made by the natives. From these details two conclusions may, I think, be arrived at. First: That a species of discipline prevails among the natives; this was evident from the regularity of their advance and retreat, and their conduct under fire. The use of fire-arms was apparently unknown to them; the rifles, judging by their approach to within a distance of 15 paces, they probably mistook for a kind of club. Second: That the attack was premeditated, as will be seen from the following particulars:—Their personal decoration must have occupied them some considerable time; their foreheads and temples were ornamented with the figure of a half-moon, painted in white. Each man carried a bundle of very long spears. They had most likely seen us sail by their encampment last Tuesday afternoon; indeed, we passed so closely as to see plainly that the place was a native encampment, by the number of small fires, the smoke from which just curled up above the mangrove

and other trees. After the skirmish our party passed by some of their fires recently extinguished by scattering about, probably with a view to conceal their proximity just before the attack. Around their fires were strewn fragments of greenstone (syenitic) with conchoidal fractures, broken so as to adapt the cutting edges for making and pointing their spears, chips and shavings of which lay in all directions. Specimens were obtained of this greenstone and also the limestone (a brecciated limestone) which is used, after burning, as a paint. Several other geological contributions were brought away from the vicinity; they nearly all belonged to the primary group.

None of the native weapons were secured, as it was not deemed expedient to follow them into the mangrove thicket; and the whole affair from beginning to end occupied so short a space of time that not one of the party noticed even whether the spears were barbed or not. The half-moon figure seems to be their war standard: even the night previous to the encounter we noticed the shape of the fires on the side of the hill above their camp, to have a half-moon-like outline. In person the natives were tall, broad-shouldered, muscular, and exceedingly black. Their hair was straight and tied at the back of the head. They had no covering whatever. Our party remained on the spot for about half an hour afterwards, collecting such botanical and other specimens as lay in their way. Just before leaving in the boat, the native women and children, who, from higher ground, had surveyed the attack, commenced a wail which resembled that fabulous Dutch concert, where every performer contributed to the harmony by playing his own melody *fortissimo*, all commencing at a given signal. One remark more may be worth recording, perhaps, as it may tend to prove how little communication takes place between the various native tribes. When the attacks were made on Grey and Stokes, the natives invariably retired when a shot was fired, or, at latest, when the first man fell. Here, however, it was only at the second shot that some connection between the boat party as a cause, and the falling of their men, as an effect, seemed to dawn upon them. The report of the rifles did not produce the slightest hesitation or sign of fear. The afternoon was occupied in attending to botanical specimens, securing various packets of seeds, and so forth. A very pretty gomphrena was among the botanical collections of to-day.

At 4 P.M. the land party returned. From the summit of the hill they had seen the River Glenelg, distant about six miles to the eastward, and they recognised the large lagoons with streams running into them, as laid down in Grey's chart. They also saw the River Gairdner and the land away to the north as far as Camden Harbour. But the 30 or 40 miles of low flat country, as shown upon Grey's chart, seemed from the position of our party to consist of

well-grassed ranges of hills, with here and there fertile flats. The hill from which these observations were made was about 600 feet above mean sea-level; but viewed as this part of the country was by Grey from a distance of 15 miles or more, and at an elevation of 1000 or 1200 feet, it doubtless presented an aspect exactly corresponding to that mentioned on the chart. The party also sighted the Glenelg running towards George Water, and also its upper course above the rapids, taking a general southerly direction. They also observed a chain of mangrove marshes running from some swamps, on the northern side of the hill, towards and into Camden Harbour. From these observations and bearings it is probable the water we are now in has no navigable communication with the Glenelg nearer than George Water. Only one opening remains to be examined and that lies in the north-east corner of George Water, so named after the discoverer of the inland Glenelg. The impenetrable mangrove-swamps forming the northern boundary we propose to name "Barlee's Impediment," after the Honourable the Colonial Secretary of Western Australia. More tracks of alligators seen in the mud to-day.

*June 26.*—At 9 A.M. a large alligator, not less than 20 feet in length, came out from the mangroves abreast of the vessel and slowly floated along with the receding tide, just below the surface of the water. With the binocular glasses we could clearly distinguish the head, eye, ridges of the back and tail, and observe the slow paddling motion of the feet. The master of the vessel, whilst out with the long-boat in search of fresh water, saw a small alligator, about 3 feet in length, on a mud-bank; he fired with shot, but these glanced from the creature's back as if it had been a coat of iron. At 10 A.M. the boats again left to buoy the stream to an anchorage nearer the spot where they expect to find fresh water. At noon the boats returned; they found an abundant supply of fresh water and cut a road through the mangroves to the water's edge in the creek. The master buoyed the passage to within a few yards of the road. At 5 P.M. set sail to go up to the new anchorage. Anchored again in one fathom water, at low tide, about a mile and a half from last anchorage, up the north-west stream, past the confluence. The tide even here rises 36 feet. There is plenty of fresh water in the bush: almost every little gully yields a supply. It is perfectly fresh, but it has a slightly bitter taste, only just perceptible. During the night an exceedingly heavy dew falls here. Lying on the deck to sleep, we are obliged to make an awning of the mainsail.

*June 27.*—At daylight the gig, manned by two of our party, and one of the men, left the vessel, with provisions for two days, to explore the north-east corner of George Water. Shortly afterwards all spare hands left in the long-boat with two hogsheads to

fill with fresh water. At 9 A.M. the first trip was accomplished : they brought back 130 gallons of water. The obtaining of it, however, was very hard work. They had cut down mangroves from the spring to the landing-place, a distance of nearly 200 yards, and with the felled trees they made a corduroy road over the mud : along this road the water had to be carried in buckets to the boat. The road was passable on foot for a man carrying two buckets full of water, but not solid enough to bear a hogshead when filled ; otherwise the watering might speedily have been concluded. I was left, with the steward only, in charge of the vessel : in the event of an attack by natives—here the creek is not 50 yards wide at low water and only 6 feet deep—I consoled myself with the belief that if the steward could only load fast enough we could manage to hold the *Foam* for some hours. The tide was still nearly 36 feet here. Only four hogsheads of water were obtained to-day : the softness of the mud proved a greater hinderance than was expected.

June 28.—At 1 A.M. the gig party returned. They have found a passage into Grey's part of the Glenelg, through the little bay to the north-east of George Water ; the accurate examination of this bay was abandoned last Wednesday as unpromising. The Glenelg falls into this bay, which I intend to name Maitland Bay, by a very narrow mouth, situated on the eastern side, as I have hitherto firmly believed by every indication : the appearance of the ranges warranted this conclusion ; and the fact that the chart of our voyage, plotted up to the present date, leaves a blank of scarcely two miles between our survey and that of Grey, made the case stronger ; the banks of each part of the river in the two charts trending towards the other in the most unmistakable manner, and, seemingly, inviting us to persevere and accomplish their perfect union. This might have been done three days ago, had a more thorough examination been made ; but Wednesday's search in the same direction proved useless, solely from over anxiety on the part of the explorers engaged. They did not deem themselves justified in spending an hour more in that direction ; because (1) the stock of fresh water (our total consumption exceeds 50 gallons per diem) was getting low ; (2) there seemed but little hope of a navigable river flowing into Maitland Bay ; and (3) to the north of our anchorage a sufficiently broad and deep stream lay immediately before us. This, after very accurate and determined examination proving to terminate by numerous branches in mangrove-creeks, not passable by the gig, and in many places traced to the very base of the hills—this brought about the resolution to undertake the land exploration of Thursday, and the boat trip of yesterday, which have resulted so perfectly to our satisfaction.

Before quitting this series of mud-islands and mangrove-swamps, I could have wished to preserve an accurate delineation ; but in-

artistic skill suffices not to record faithfully any of the varied effects. Photography alone could portray the minutiae; I can only compare the effect to that of a level country with clumps of varied and exquisitely green trees, having openings—now straight—now serpentine—ever graceful; with a ground of crystal reflecting every leaf with an almost exaggerated accuracy. Reference to the meteorological journal will shew an almost entire absence of wind and cloud during the past week. The tides are regular, and at springs rise 36 feet. High water in the "Impediment," at full and change, would be, by calculation from observed tides, at 9 A.M. But the highest tides occur three days after the full and change.

At 6 A.M. got the anchor home and, towed by the long-boat, proceed south to the mud-bar, *en route* to the newly found passage to the known part of the Glenelg. The south-west passage from George Water to the sea bears south-west from the anchorage of Tuesday last. Native fires still discernible to the West of Cooper's Creek, but at some distance inland. Anchored at noon just inside Rocky Island at the mouth of Maitland Harbour, in the north-east corner of George Water. At 2.15 P.M. got the anchor aboard and attempted to tow with the long-boat, but we could only just keep our position owing to the force of the tide. At 4.20 P.M. a slight breeze from the south-east gave us a slight advance. The shores of Maitland Bay are of old red sandstone, covered with long coarse grass. *Adansoniæ* and *Eucalypti* prevail. A shrub (in fruit) with a strong lemon odour was obtained here, as also some varieties of *Melaleuca*, a white *Hibiscus* and some other plants in seed. The soundings in Maitland Bay averaged 15 fathoms.

The mouth of the Glenelg was entered with some little difficulty: a reef bars the entrance, but there is a deep channel near the southern end of the reef. The mouth of the river is about a quarter of a mile in width for the first mile; and it takes a general south-east course. There are several small rocky islands, in this first mile, from 25 to 50 feet in height. The banks also partake of the same precipitous character. A sudden bend of the river opens into a reach, having a northerly course of about four miles; and a width in some places exceeding a mile. This reach, like the first mile of the river, is studded with islands and reefs running parallel to the general course. We anchored to the north of a rocky point on the left bank, about two miles up the reach, in 5 fathoms water, at 7 P.M. A little to the westward and northward of the anchorage, on the right bank, there are mangrove and mud islands; and, no doubt, there is a tidal communication between this part of the Glenelg and Barlee's Impediment; at each change of the tide the set was observed to be

stronger in the direction of the Islands than in the direct course of the river.

*June 29.*—At the dawn of day, the tide serving, we hove anchor and continued our upward course. The wind was very light, so our progress was slow. After passing the northern termination of the first reach, the rocky banks of the river give place to mangrove and muddy shores; the belt appearing from the centre of the stream to be exceedingly dense. The course of the river also is now generally east by north. At about  $1\frac{1}{2}$  mile above the point the tide turned, and there being no wind we were again compelled to anchor. Soon after this, the long-boat with a party of six, left to take soundings and to explore the river. At 4 P.M. the tide left the vessel aground on a mud-bank, and in half an hour she canted over to an angle of  $30^{\circ}$  and remained high and dry. Tracks of alligators from the river up the mud are to be seen on the north bank; any one may easily understand, after an examination of mud-banks such as this on which we grounded, how fossil tracks were preserved until they were sufficiently hardened; here, on all sides, notwithstanding the rush of tidal waters, tracks we know to be at least two tides old, remain as fresh and as perfect as if just made. This we observe both in the case of birds and heavy reptiles.

*June 30.*—About 1 A.M., the long-boat party returned, having gone up the river as far as the first rapids. They landed on the country marked in Grey's chart "rich alluvial soil;" they found it level and covered with luxuriant grass, in some places 9 feet high: in other places not exceeding 3 feet and apparently adapted to the keeping of sheep. They found fresh water in abundance and a second series of rapids in the river. They report the river itself to contain sufficient depth of water between half tides to sail the *Flying Foam* up to within a short distance of the first rapids. At 7 A.M. hove the anchor and commenced towing upwards. At half-past 11 A.M. got the vessel entangled among the mangroves to our great hinderance. A north-east wind, blowing in fitful gusts, ultimately compelled us to anchor again, having accomplished a distance of not more than two miles. The tide at  $\frac{1}{4}$  ebb runs two knots per hour. At 5.30 P.M. aground: the vessel assuming an angle of not more than  $20^{\circ}$ . At 11 P.M., in a perfect calm but with a favourable tide, we again hove anchor, and for two hours drifted along stern foremost, to a postion about one mile to the eastward of Alligator Point, Long Reach. The river here gradually narrows. The tide flows with great velocity in the little bend of our evening anchorage. Duration of flood-tide, 5 hours; of ebb-tide, 7 hours. Rise 28 feet. The mud contains a large proportion of sand at this part of the river. Mosquitoes are both numerous and troublesome.

*July* 1.—At 1 A.M. at anchor in mid-stream in Long Reach in  $3\frac{1}{4}$  fathoms. At daybreak we found the vessel aground at an angle of about  $35^{\circ}$ , with a ridge of rocks just rising above the mud, and stretching across the river from north to south, about 200 yards in advance of us. Ducks flying about, but not within range. At 11.40 A.M. hove anchor. Along the banks of the river at low water we see clumps of oysters, and a shoal of porpoises has passed and repassed several times. At noon cast anchor near what appears a favourable spot for landing stock in three fathoms at high water. The long-boat with two land parties left to search along the right bank for a temporary dépôt and landing-place. At sunset the two parties met at the boat, when she was found to be about 20 feet above the water-level at the time. The mud seemed very slippery, so a line was sent from the vessel, and, the travellers having seated themselves, a slight impetus was given to the boat, when she glided down the mud at a flying pace into the water without the slightest mishap. Had the temperature been  $120^{\circ}$  lower, we might have fancied ourselves witnessing the Russian ice-hill sport. The parties report favourably of the spot selected for landing the horses, and the men have cut a road through the mangrove-belt down to the river-bank. In the afternoon, from the mast-head, took bearings of many of the hills shown on Grey's chart. Mount Lyell bears E.  $28^{\circ}$  N., and is distant about  $7\frac{1}{4}$  miles. At low water we are surrounded by detached rocks: it was fortunate the anchor happened to be cast in the midst of a soft mud-bank. At low water the vessel draws 5 feet of mud! The mosquitoes are a perfect torment here. It is not possible to keep them wholly away: although we sleep in our clothes, cap and boots included, with thick gloves and veils, the little pests, assisted in their onslaughts by minute sandflies, are continually finding their way within our lines. In fact, our only means of obtaining a few hours' sleep during these long nights, consist in fortifying our position with an outer defence of opossum-rugs, with the fur inside; and even under these apparently favourable circumstances the enemy (occasionally with success) puts into force every conceivable stratagem with a view to surprise us. The flood-tide commenced at 11.15 P.M., and in twenty minutes the vessel was afloat; after the first hour of flood, the rush of tide diminished and kept steadily on for three hours more, when the usual eight hours of ebb commenced.

*July* 2.—Before breakfast, two of the party landed on the south bank to see what game could be obtained; after an hour's absence they returned laden with spoil. One of two fine cranes shot by them measured from tip to tip of wings, 7 ft.; height, standing, 5 ft. 6 in.; from claw to lower end of femur, 1 ft. 3 in.; length of

femur, 1 ft.  $1\frac{1}{2}$  in : colour, rose or French grey, with a rose blush. Besides these, there were ducks, geese, and a teal. These birds were obtained from the swamps in the summer bed of the Glenelg, left bank ; I never saw so many varieties of birds or in numbers so great, in any other part of the world. For breakfast we had geese obtained in a raid last night ; they were of excellent flavour, but not fat : perhaps they are scarcely in season at present. The ducks are exquisite eating ; they fly over from one side of the river to the other in vast flocks. At 45 minutes after noon we commenced landing the horses, and in an hour they were all safe ashore, in very fair condition. Not one of them has suffered more from the voyage than a week's rest and green food will remedy. The landing, although conducted in rather an every-man-his-own-master style, was certainly as smart and as successful a work as could be wished. At 3 P.M., five of the party started with the seven horses to travel up the right bank of the river to the spot selected for the temporary dépôt, whilst the long-boat under the guidance of the master of the vessel carried a load of provisions and stores by water. The long boat returned at sunset having left the dépôt party with the horses safely encamped.

*July 3.*—A watering party went to the rapids with two hogsheads. They returned at 4 P.M., having been detained only by the tide. Preparing now for bush exploration. We propose first to examine the country between this and Camden Harbour. Amongst many highly interesting botanical treasures secured this day, I find a very beautiful bunch of flowers gathered from one of the numerous white acacias, which we here find growing plentifully on the banks of every fresh-water stream. It is generally associated with the palm. As the palm alone here seems to be an unfailing indicator of fresh water, so this acacia would appear to be a finger-post to point out streams plentifully supplied and constant. The tree here attains a height varying from 15 to 30 feet ; but at a mile or two of distance from the mangrove-belt which fringes every salt-water stream, it attains, in some instances, a height exceeding 100 feet. In every detail it answers to the description of Mr. F. Gregory—"very handsome tree, resembling an ash . . . . bearing a beautiful white flower, 4 to 5 inches across, having on the inside a delicate tinge of yellow, and yielding a sweet scent like violets."\* Some bunches of this exquisitely beautiful flower measured  $3 + 2 + 2$  feet. Where several of these trees happened to be in flower, in close proximity, the violet-like odour was perceptible at a great distance. Our old friend the very beautiful pea,—of a bright scarlet colour, with a jet-black spot on one end,

\* 'Journal of the North-Western Australia Exploring Expedition,' F. Gregory, p. 18.

is still met with in every ramble ashore. These peas appear from the seed-pods to be precisely similar to those of *Abrus precatorius* which come from the East and West Indies, where they are used as beads. The leaves and root of this plant taste like liquorice. In the West Indies the *Abrus precatorius* is called wild liquorice. The roots abound in sugar, and from experiments made since the return of the expedition, I believe them a perfect substitute for liquorice in every respect. These beautiful seeds are strung for necklaces and other ornaments by the people of both Indies. Their specific name (*precatorius*) was given from the fact of their being occasionally made into Rosaries. De Candolle, speaking of the *Abrus*, says, "these plants attain a height of about 9 ft. The seed is a wholesome pulse." Hughes, in his 'Natural History of Barbadoes,' treating of *Cajanus flavus*, a pea most closely allied to *A. precatorius*, says:—"I know of no part of this shrub but what is of some use. The wood is good for fuel, and by the often falling of its numerous leaves the land it grows upon is very much enriched; and its fruit is of great service by affording hearty, nourishing food to man and beast. The peas, green or dry, are boiled and eaten, and esteemed very wholesome, especially if eaten in the wet time of the year; for, being of a binding quality, they prevent diarrhoeas and dysenteries, so common in wet seasons. The branches, with the ripe seeds and leaves, are given to feed hogs, horses, and other cattle, which grow very fat upon them." Nearly every word of what is here said of *C. flavus* applies to the pea now found growing abundantly in the Glenelg district. Here, too, the aborigines have discovered the valuable properties of this useful legume: for on the 31st July, on an island in Collier Bay, many pods of this pea were found among the remains of a native feast, although no plants were observed growing upon the island.

*July 4.*—Went to the dépôt in the gig: it is just below the first rapids, on the north or right bank of the Glenelg, and within the limit of the summer bed: not a very nice spot. The grass is plentiful, but rank: so much so that the horses feed away to sweeter grass growing within a very short distance to the north and east. Mount Lyell is just visible among the trees, distant about  $4\frac{1}{2}$  miles north-east. Camden Harbour would seem to bear w.  $33^{\circ}$  n. from us, and to be distant about 18 miles in a right line; but so many ranges of high hills intervene, that we have no expectation of seeing the sea-coast in that direction, until we are within a distance of a few miles. In some fresh-water pools around the encampment, a lily of great beauty grows abundantly.

*July 5.*—At 8 A.M. walked to a hill about a mile and a half w.  $11\frac{1}{4}$  n., to seek ground for the measurement of a base line, but no suitable locality was found. The hill proved very rugged;

in some places the stones had sharply cutting edges, in others they were rounded and loose,—piled in heaps; in all cases, owing to the luxuriant clothing of grass, they were seldom seen before they were felt. There is no great variety of grasses on our route of this morning, but all are thickly growing, and in height run from 3 to 7 feet. Nearly all the hills appear grassed to their summits. This hill, which by Grey's chart is in a line with our dépôt and Mount Yule, afforded no extent of view to the north; a higher range, about two miles distant cut off our view in that direction; but to the east our range of view extended to Mount Lyell and its neighbouring hills. The horses are eating better to-day; it was, of course, no more than might be expected that horses after being on board ship for a month, and being in the mean time transferred to a new country, should, when landed, eat sparingly at first of their new food. Even the sheep to-day looked round bewildered, and showed but little disposition to eat. They cannot understand at first that grass four feet high, somewhat coarse and dry, as it is near the dépôt, from the advanced period of the season, is their destined food for the future. But in a few days all kinds of stock will feed amply here. The little tree with melon-like seed-pod and lemon odour is now in flower all about these hills. Its yellow flowers and leafless stem look very curious as they peer above the high grass. I saw no specimen exceeding 9 ft. in height. Walking among the acacias after sunset reminds one acutely of the little violets in the old country. In the afternoon sought for beetles, but after a diligent search, extending over nearly four hours, I was only rewarded with two or three small specimens. A few Geocores and Mantidæ were seen, but not captured. Whilst hunting for insects, I came across a dead tree with the bark off, for a space of 3 ft. 6 in. all round. I tested the wood with an axe—it was exceedingly hard, and made the axe rebound. The barking I do not think to be the work of aborigines, as it is so regularly done, and apparently with a keener edge than the stone axe of the Australian native. As our camp is situated close to the Rapids, as the tree is much older than any of the trees in the immediate vicinity, and would therefore be selected for marking by any white man, and, as Grey's route on my copy of his chart runs close to this spot, I am convinced that the tree is one marked by Grey's party.

#### LAND EXPLORATION TO CAMDEN HARBOUR.

*July 6.*—At 7 a.m., barometer 30·105; thermometer 55·8; wind 0, cloud 0. Yesterday I found a plant that had the smell and taste of mint, and another that smelt strongly of musk. At 9.30 left camp with two of our party, three saddle and two pack-horses, with

a fortnight's provision, having for our object to reach Camden Harbour, and examine the country between the Glenelg and the sea along the north-west and north boundaries of the district. Hanover Bay and the Prince Regent's River we do not at present intend to explore. I should describe the country between our starting-point and our noon camp as well fitted for sheep, especially after the present growth of grass has been burned—as for feeding it down, it would be impossible. The riding over it now is very rough work, because we keep as nearly as possible to our proposed course N.  $57^{\circ}$  W., over hill and valley; but if the object was to find an easy road, I can see no difficulty whatever. Pitched our camp at 5 P.M. on the western branch of the Gairdner River. The afternoon's march has been much easier than that of the morning, and we have passed over a greater distance (6 miles) with less fatigue to our horses. From the summit of a range 600 to 700 ft. high, a beautiful prospect was obtained. The whole of this day's track lies through a splendidly grassed country; few birds have been seen, but kangaroo and turkeys have been noticed beyond range. My two companions ascended a hill to the west, and from the top they could see the line of swamps extending towards Camden Harbour. During the night a heavy dew fell, and some birds, uttering a cry I could not recognise, flew over our camp.

*July 7.*—Started at 7 A.M.; country good at first and easy to travel over; rode two miles to the foot of a double-cone hill, 500 feet high, then turning westward  $3\frac{1}{2}$  miles round the base of two hills, one of them 700 feet in height, and  $2\frac{1}{2}$  miles north of fine country to another hill 800 feet high, from which we had a magnificent view of sea and islands in Brecknock and Camden Harbours, with arms of the sea both north and south. From the hill to our camp, one mile, the country was exceedingly rugged, with steep hills coming almost to an edge up and down. In a rocky gully of coarse red sandstone I obtained a large collection of shells. The grass was rather coarse and rank, like coarse wheat-straw; the country more rugged, but still easy and well grassed; noticed some poor sandal-wood, also acacia, baobab, and palms, and a rose-like vine. Good water, probably permanent, is found wherever palms are seen. Camped near the southern arm of the sea, which terminates in mangrove-swamps running towards a remarkable conical hill nearly due south.

*July 8.*—Travelled over a country with perfectly easy succession of undulations, then crossing the heads of several tidal creeks with mangroves, one of which we attempted to cross but failed, found a particularly easy country with gravelly soil stretching quite across the neck of the peninsula towards Camden Harbour. It was singular that our route of yesterday should have been so remark-

ably rough; we chose it because it appeared the better of the two, but our march of to-day, although only a short distance from it, may be considered quite easy and well grassed. At 1 P.M., ascended a hill and took bearings; pack-horses and all went up here; we had a magnificent view of Brecknock Harbour; the green islands studding it and its silvery unruffled surface, from the position in which we stood could only be compared to emeralds in a broad setting of silver. The view was so enchanting that I unwillingly ceased gazing at it to resume the dry work of taking observations. Camden Harbour is somewhat disappointing, it seems, as we look down upon it, so small after those magnificent sheets of water Collier Bay, Doubtful Harbour, George Water, and others. From Camp 4 we passed to a hill about one mile south-east of Camden Harbour, 600 feet high, and then on our return route to Camp 6, half a mile south-east, where we noticed a remarkable geological formation—quartz veins through sandstone. At 4 P.M., resumed march  $2\frac{1}{2}$  miles west to the southern heads of Brecknock Harbour, and after passing very tolerable country formed Camp 7 in a well grassed and watered locality. During the night some heavy four-footed animal trotted past at no great distance from our camp, to the great terror of Peter, the pony. I am curious to know what creature it could be; it was evidently a heavy beast, and its motion I noticed very carefully, and can only compare it to a distinct trot. Butterflies abundant and beautifully coloured, but I do not catch as I cannot preserve them.

*July 9.*—At 8 A.M., *en route* passing over a particularly easy country, chiefly with a gravelly soil of quartz, ironstone, old red sandstone, and trap. Here and there this easy country was cut by belts of strong country with coarse grass, but still not so rough in any place that a bullock or horse team could not travel all the way. Passing south of the double-coned hill, we made a course east by south, cutting all the little streams that drain the MacDonald Range, under which we camped at noon on the most eastern bend of the Gairdner. Under the range there was fine grass and large timber; the river has permanent water; in some of the pools was a carpet of lilies in flower; palms abundant, water excellent, and characeæ and other water-plants numerous. At 3.30 P.M. resumed the march  $4\frac{3}{4}$  miles to the first of the streams rising in the MacDonald Range and flowing into the Glenelg, over magnificently grassed downs, gently undulating, but elevated 240 feet above mean sea-level, which I proposed calling "Hampton Downs;" they divide the streams falling into the Gairdner and Glenelg. Exquisite palms all around our camp.

*July 10.*—To the Depôt camp. All the country we passed over is beautifully grassed, but as we approached the depôt the grass became coarser; the soil is a rich alluvium nearly the whole dis-

tance. We found all well in camp. The parties looking for land seem disinclined at present to leave a dépôt party here, but this is a magnificently grassed and well-watered country, with a practicable natural dray-route all the distance from Camden Harbour to this dépôt. The whole of our route during the past week is fringed by timber of sufficient size and in sufficient quantities for all building and pastoral purposes for many years to come; we have already seen 300,000 acres of land of the finest quality for grazing, and at present, although it is now drawing near to the close of the dry season, clothed with grass of the most luxuriant growth. During our march of this morning there were places where, as we rode along, we could not see each other for the grass; in fact the grass-seed was at least three feet above our heads. It is the opinion of us all that the lowest estimate of the carrying power of this district is a sheep to an acre, therefore 300,000 sheep might be fed upon it; but in this estimate of land we do not include the sandstone ranges we have seen, which, although so precipitous as to be impassable save on foot, are still well grassed and available to the depasturing of sheep, and in process of time, as the more easily traversed land becomes stocked, would naturally be included in the runs. But to what extent the ranges would increase the pastoral lands of the district north and north-west of the Glenelg, it is impossible now to conjecture; it is very easy, however, to foresee that in a short period after the settling of the country, ramblers in search of game, or shepherds would discover easy passes through them, and feeding valleys to their summits. Another matter worthy of notice—we have not yet seen one of the many poisonous plants, the bane of the south of this colony, and to eyes so well accustomed as ours to the various kinds, they would if here, before this, doubtless have become apparent.

*July 11.*—On board the vessel; found all the collections of specimens I had left behind excessively damp, and the botanical ones I fear spoilt. During the last night the mosquitoes prevented all chance of sleep, in spite of smoke or any attempts at covering ourselves up. In the morning a shooting party left for the lagoons on the south side of the Glenelg, returning at noon with a goodly supply of game. One of the silver-grey cranes measured 7 feet 6 inches from tip to tip of wing, and 5 feet 10 inches from toe to beak.

*July 12.*—A day of rest.

*July 13.*—Went to the dépôt, as it is proposed to start this day on the south and west exploration; on our way up in the long-boat saw eleven alligators on the mud banks, some we estimated at 6 feet, others at 25 feet in length. Left the dépôt at 2.30. p.m. with two saddle and one pack horse, carrying a fortnight's provisions. By a direct course steered for Mount Lyell, distant

4½ miles from dépôt, and visible all the way ; reached it an hour before sunset, camped and then ascended to the summit. It has changed its appearance very much since Lieutenant Grey described it, and is now clothed with grass and trees ; from a clump of huge stones on the apex we had a magnificent view of the surrounding country, extending over the Prince Regent River on one side and the Glenelg district on the other.

*July 14.*—Left our camp at the foot of Mount Lyell and steered a course generally s. 20° E. until noon, 4½ miles. The first mile was over very rough but well-grassed country, with the largest timber we have yet seen, and water everywhere ; the last camp was our first experience of water without palms, there replaced by three species of acacia. The second mile was over an excellent grassed and well watered country, the third and fourth the same, but larger timber ; the last half mile was over sandy and rocky country very difficult to travel over, having deep creeks and water-holes equally difficult to cross. When we struck the Glenelg it was at a fine deep reach, one-eighth of a mile broad, with little current in it, and its sides were fringed with lofty eucalyptus and cajeput trees, with fine grass down to the water's edge. Many new flowering trees were passed to-day, and kangaroo seen several times. Palms everywhere around us. In the afternoon, after two hours' particularly difficult travelling both for selves and horses, we only made one mile, and camped in a gully running into the Glenelg ; we ascended the hill, out of which the gully runs ; it was nearly all stones piled loosely, and spinifex here and there, but with a fair proportion of feed. I was astonished to find a very fine acacia growing among the pile of stones on the top of the hill, sufficiently large to enable us both to climb it, and, sitting among the branches, to take bearings. Here are rapids in the Glenelg, which in the rainy season must afford a magnificent landscape, as the fall in the rocky bed is not less than 50 feet. Fish in the river and the water extremely good.

*July 15.*—*En route*, steering a general course of s. 20° E. After travelling an eighth of a mile we entered what we may well call "the Happy Valley ;" this was a valley running to the southward, of no great breadth (say an eighth of a mile in the widest), clothed with a very carpet of green grasses. The first pines we had seen here fringed our track and formed, with the old red sand-stone walls bounding the valley on either side, picturesque clumps of eights and tens intermingled with palms, acacia, eucalypti, and melaleuca, of great variety and beauty. A deliciously cool and clear stream of water flowed everywhere copiously along the valley ; we disturbed birds of varied hue, but mostly of brilliant colours ; one kind of parrot struck me as peculiarly beautiful, the head and tail of bright green, the wings of a silvery grey hue ; pigeons were

numerous, but small; at the upper end of the valley two stately emus, at different intervals, gave us first an inquiring and suspicious examination, and then in turn afforded us an opportunity of observing their powers of retreating. The "Happy Valley" terminated in a happier circular plain of about half a mile diameter, covered with the most luxuriant grass, not less than three feet in height and perfectly level; this plain was bounded by timber of different kinds and a wall, broken here and there, of old red sandstone behind the trees; the first Banksias we met with grew here. From the plain we ran up a creek bounded by rocky walls to its source in the dividing range, the route being over a chocolate-coloured sandy detritus; the neighbourhood had been lately burnt, was easy to travel over, well watered and grassed, and had an abundance of fine timber. Our afternoon course was over exceedingly difficult country for three quarters of a mile, then, branching westward, to a gully running parallel to that of the morning, we continued our course over a similar country until we arrived at a large flat, where we camped for the night. Just before making camp we saw extraordinary proofs of the recent presence of some very large, and, I should say from the tracks, five-toed herbivorous animal; during the day we saw a large stone-coloured snake, black cockatoos, and numerous kangaroos.

*July 16.*—My companion went to the top of the range bounding the eastern side of the swamp, and on his return reported that the country s.  $30^{\circ}$  w. promised easier travelling, and we therefore started on that course. After crossing the Glenelg and a most important tributary, at a spot which we denominated "Rocky Springs," we camped. An entomological research produced me only 30 coleoptera, of three or four species; a beautiful white moth with red markings rewarded me. Native fires sprung up in all directions towards sunset; it is evident the aborigines are close to us.

*July 17.*—Ascended a hill 1300 feet high. There are between this range and the Prince Regent River three distinct high ranges; one about 12 miles s.  $20^{\circ}$  e. appeared clothed with grass of the colour of that on Mount Sturt, and apparently as coarse. All the country within this radius of 12 miles I should describe as second-rate compared with the country north-west of the Glenelg, but still it was well grassed on the strong ridges, and magnificently grassed on the flats; it is equally well watered, and possesses finer timber. The hill is singularly uninteresting in a scientific point of view, no specimen of any kind having been collected upon it except the cast skin of a small lizard; no flowers, no insects, except ants and flies; the latter are a daily pest except when travelling; a few butterflies alone gave colour to the eye; clumps of spinifex appear towards the apex.

*July 18.*—Returned to the last camp, taking a more southerly

route. Thence N.  $30^{\circ} 10'$  w. to the Rocky Springs, passing through some rich alluvial flats, having on our left a stony range well grassed and timbered. We have several climatic nuisances—flies by day, mosquitoes by night, and ticks manifold both by day and night; beyond these trifling discomforts, the climate, since we passed the north-west Cape, may be described as heavenly; only just warm enough in the middle of the day to make shade preferable to sunshine, and the nights delightfully cool but not cold.

*July 19.*—Whilst gathering palm-leaves to make a fire, I noticed a very beautiful wasp's nest pedicillated delicately to the under side of the green leaves; I was almost too late, however, when I returned, to effect the capture of one or two specimens; they seemed quite indignant at the intrusion, and threatened dire vengeance if molested. The capture of one or two of the ringleaders soon caused the rest to retreat, leaving their city with its inhabitants, in every stage of waspdom from the egg to the larvæ, an easy prey to my spirit bottle. Started, and by picking our way carefully up and down the gullies crossed the Glenelg, by cutting down the palm jungle, after an hour's hard work, camped  $1\frac{1}{2}$  mile further on, having only accomplished  $4\frac{3}{4}$  miles direct, at 1.30 P.M., owing to one of the horses having been severely cut the previous day. All the ground passed over during the last three days has been recently burned by the natives. The bed of the river here is drift sand, indicating a river-bed in the summer of 300 to 400 yards in width, fringed by lofty cajeput, eucalypti, acacia, and occasionally dense palm-jungle. I noticed one fine white gum-tree. After dinner I went upon an entomological tour about a mile down the rivulet towards the Glenelg, but with partial success only as to beetles, there being so few flowering trees and shrubs in blossom at this season. In places here the white ants are very numerous, and their hills are frequently from 5 to 6 feet in height with a diameter almost equal to the height.

*July 20.*—The period of sunrise here is a daily feast: a cloudless sky, not a zephyr stirring with sufficient force to move the smallest leaflet, and a temperature perfectly enjoyable, even clad, as we were, in our travelling garments, which are simply our usual under-clothing, boots, trousers, and outer Crimean shirt, a silk neckerchief, which serves as a cap at night, a light cloth cap, with calico cover cut after the Indian mode, with a well-projecting peak to protect the eyes from the noon-day glare, and a veil about 10 inches square rolled round the cap, except when flies and mosquitoes are troublesome; these, with stout leather gloves only worn on state occasions, such as breaking a road through prickly bush-rose vine, acacias, or palms, complete our toilet of every day and Sunday. Started at 9.15 A.M., and after crossing two broad reaches of water at 1 A.M. crossed our southern track and thence

pursued our route down the Happy Valley, whence we passed over 2 miles of stony ridges and 2½ miles of easy well-grassed country, and camped on the Glenelg.

*July 21.*—Travelled over easy-grassed country as far as Mount Sturt, where we were long delayed in crossing the Glenelg, and by a reedy swamp running into the broad stream near Mount Sturt; reached the dépôt about noon. Went to the vessel to pack away specimens and returned with instruments for measuring a base line, and took lunar distances in the evening to determine the exact position of the dépôt. Since our departure all hands at the dépôt have been occupied in cutting grass for hay, any quantity of which is at present to be had for the cutting, and it is of good quality and in such profusion all around us that ships might obtain cargoes of it as quickly as it would be cut, made, and pressed into bales. One of the first objects that met our eye was a tolerably neat press, erected in the midst of the camp, after the manner of a primitive wool-press; close beside the press lay six wool-bales of well-pressed hay, and about a ton of loose. During our absence a good addition has been made to my geological collection, which now includes what I take to be a fair number of specimens of the chief geological treasures brought from the hills by the summer floods of past centuries; many are of a highly interesting nature, either from their exhibiting the general geological features of the district, or from some peculiarity of conformation of strata or crystalline arrangement.

*July 22.*—The party propose to send some of the hay on board to-day, from this I presume it to be their intention to reship some if not all of the horses, which I cannot think a wise proceeding, for these reasons: first, because a district of unsurpassed fertility has been found and traversed, possessing abundance of feed and water for half a million of sheep, together with timber in far larger quantities than will ever be required for building and fencing purposes; a district blessed with a climate which, at this season of the year, is a joy to live in, with evidences of continual and periodical summer rains of sufficient amount to warrant us in the supposition that this is no exceptional year of fertility, but that an annual supply of grass of a like quality and in no less quantity might reasonably be predicated; a district having a fine and securely land-locked harbour in Brecknock Bay, with a country of almost unequalled fertility immediately adjoining, and fit without road-making to drive a bullock or horse team over it at once so far as even to the very centre of the district: a district having a river leading from the southern harbour, in Doubtful Bay, to the very heart of the grazing country—a river I should describe as safe and easy to navigate with cargo-boat, or a small steamer, from George Water to the rapids, and south of the actual river-entrance

in the north-east corner of George Water, perfectly secure for vessels of any class or size, especially if the south-west opening of George Water into the sea should prove, on our return trip, to be wider and less tortuous than the entrance through which we sailed from Doubtful Bay. Here I must admit that although the *Flying Foam* came safely through the passage, and the actual river entrance from George Water, still the work was hazardous (doubly so then from the fact of ours being the first soundings taken there), but even now, viewed from the most favourable point, a work fraught with visible dangers to any vessels larger than cargo-boats of 10 to 15 tons. At 10.30 started with Mr. Aubry Brown to measure a base line south of Mount Yule. During the whole day it was exceedingly sultry ; being on a low mud-flat only just above low-water mark, without wind or cloud, we certainly felt the heat more than on any day since we landed in the Glenelg district. After finishing our chain line and solar observations, we discovered a convolvulus with the leaves and vine dry and dead, twined round a mangrove ; the seed was quite ripe ; the signal for our recall sounded from the ship, the tide was then high enough for us to get on board without difficulty. Our usual mode of going on board from the mud-banks has been by a process, compared with which a mud-lark's trade on the Thames is clean work, much more pleasantly described than performed, but this is a favourable description of the process : after a toilsome walk along the northern margin of the mangroves we reach a spot where, at low tide, we are just able to wade through the mud and spots of water left by the previous tide, and then by a decidedly muddy and circuitous route reach a road cleared through the mangroves to the edge of the mud-bank proper, when, although we have a road-way paved with mangrove-logs, we sink up to our knees on a bluish grey mud of the consistency of dough, and in some places a man would sink over head in it if unacquainted with the geography, and then by a series of ungraceful evolutions glide alongside or into the boat to be put on board the vessel, objects to be carefully shunned and commiserated ; we wash and change our garments and sit down perfect *bonnes bouches* for the mosquitoes. In early evening, that is by the liberal use of smouldering rags, we obtained a respite from the mosquito nuisance, but from that hour throughout the night an unceasing hum was kept up by clouds of these pests hovering about our heads, but wholly defeated in my case by the manner in which I was packed up in my rug on deck ; as to sleeping below, of course no one has been so venturesome as to attempt it during the past month.

*July 23.*—This morning I found an entomological treasure in the shape of a tick upon my left arm : it was in the same condition as we usually find them—the head buried in the skin immediately

over a vein, and its body swollen with its stolen food ; it was larger than those we found on the Upper Glenelg. I tried the experiment of making it disengage itself by putting the lighted end of a match to its body ; but it required a second application before it would show any signs of relinquishing its hold. This individual seemed unfitted for the experiment of drowning by oil from the hardness of its epidermis ; but other species, as soon as a drop of oil is placed on them, disengage themselves quickly, owing, I presume, to the closure of the spiracles by the oil and the consequent stoppage of their powers of breathing. As they are frequently met with in many parts of Australia, and as I am not aware of the existence of any recorded observations on their anatomy or habits, I think it will not be time thrown away to take measures to obtain as many species as possible and make some enquiries into their history, the more especially as I know no greater plagues to travellers in these parts of the world. It is not so much the immediate as the remote consequences that are to be dreaded, for if incautiously the creature be detached summarily on its discovery, or rubbed off by the hand, its presence being undetected, its head may remain in the skin and then there is formed a hard callous lump, which I have known to become a source of pain and anxiety for two years after the first formation. Towards sunset two of the horses and a party arrived from the dépôt, and were got on board preparatory to leaving the river. I am lost in amazement at this resolve ; for granting the cost of leaving a dépôt here, I ask myself, can they expect to find 500,000 acres of land, in any part of the world, capable of carrying perfectly half a million of sheep, at a cheaper rate ? However our exploration will open to some future occupants this tract of superb grazing country, certainly inferior to none in the world that I have seen, and I have travelled much. In the evening the whole party returned to the dépôt.

*July 24.*—This morning an alligator was caught by one of the sailors : it was 6 feet in length, head 1 foot 4 inches, first pair of feet 2 feet 5 inches, second 2 feet 9 inches, circumference 2 feet, and weighed 80 lbs. I skinned and dissected the creature, preserving the cervical vertebrae, lungs, skull, and skin. In the afternoon the remainder of the horses arrived from the dépôt and were got on board.

#### FROM THE GLENELG RIVER TO COLLIER BAY.

*July 25.*—In the early morning the long-boat went to the dépôt for the sheep, and returned at 8 A.M. when they were forthwith put in their pens. During the day I was employed in cleaning, preserving, and stuffing the bones and skin of the alligator, a tedious operation, as some of the smaller bones are so exceedingly thin that

the slightest cut would have easily passed through them. At dusk we left our anchorage and towed down the river to long. E.  $124^{\circ} 43' 52''$ , s. lat.  $15^{\circ} 43' 8''$ , and stuck fast in the mud at 9.45 P.M. We did not perceive this bank on our upward passage, or we might easily have avoided it and continued to use the tide for another hour. On reference to our chart of the river we perceive our track runs along the northern edge of the bank: as shown by the soundings this bank can scarcely be called a hidden danger, for it consists of a deposit of mud about a foot in depth lying on a smooth bank of sand, thus affording a safe berth to any vessel during the receding tide; but of course if the vessel were not somewhat flat-bottomed she would have a considerable list. For two hours before low tide we were left high and dry with the river running placidly on either side of us. This change of anchorage of last night was a boon appreciated by every individual on board—we were actually enabled to sleep with our faces uncovered. Just before leaving our anchorage a desperate attempt was made to capture a large alligator floating in the river like a log: one shot from a rifle was fired and the ball undoubtedly struck the creature somewhere, for by its rapid lashing of the water we can only suppose that it was in a flurry, at the very least; but, alas! when the vessel's gig and a numerous party reached the spot, no reward awaited them save the view of the still troubled water. One can imagine the creature, when aroused from its reverie by the leaden messenger, to give a look of intelligence around it, and on catching a glimpse at the advancing boat, to resolve, all things being well considered, to explore the bottom of the stream and recline its aching head on its customary mud-pillow, at any rate for a season.

*July 26.*—At 8 A.M. left our anchorage, and by dint of sail and towing proceeded down the river at a tolerable speed. At 11 A.M. ran aground on a mud and sand bank half a mile south-west of our anchorage of June 6: the vessel was so far fortunate enough in her choice of a berth, as to have avoided a mass of sandstone rocks and boulders, which at low water we found immediately east of us, and against which, if she had struck, an unlucky thumping would have brought us to a stoppage less easily than the mud did; moreover the rocky heap was a foot higher than the mud-bank, and the vessel could not have assumed so upright a posture during the interval before the flood-tide of the afternoon. The shoal patch I purpose naming “Sunday Shoal.” At low water many of the party and some of the crew got over the side of the vessel to seek shells, &c.; they were so far rewarded as to find an abundant supply of hermit crabs, which were new to many of them. None of the shells obtained struck me as being very curious or new. The party on the bank spread far and wide over the ground in quest of Gle-

nelg treasures,—I cannot say the treasures of the deep, for when the vessel grounded the lead proclaimed  $\frac{1}{4}$  less 1. Just before sunset the vessel, in swinging with the flood-tide, bumped and grazed upon the rocks in the bed of the river; there are not two fathoms on the rocks at high water. After sunset we sailed to a point in the river, long. E.  $124^{\circ} 42' 10''$ , lat. s.  $15^{\circ} 45' 34''$ , three miles from our anchorage of the 28th June, and then anchored to await the tide of to-morrow morning, so that we may have daylight to pass the narrows and rocky islands; it would be imprudent to attempt the passage in the night owing to the force of the tide. We observed at our last anchorage that there was a considerable set of tide out of the opening opposite to which we were anchored. This would argue some other communication of the river with the sea, besides that with which we are already acquainted: this, although a question of great interest, would be a matter, the solution of which would now be quite foreign to the object of the present expedition.

*July 27.*—Sailed at 7.45 A.M. with tide and wind north by east, in our favour; notwithstanding this it required the boat, manned with four hands, to keep way upon the vessel from time to time. Cast anchor in Maitland Bay at 11.20 close to the anchorage of the 28th June. Nearly the whole party was here engaged in securing a baobab-tree and collecting seeds. The inner part of the baobab set us all to work chewing away, some pronouncing it almost as good as cocoa-nut; but for my own part I think it tasted more like Indian rubber. At 8 A.M. sailed and passed through the channel between the two islands off the southern extremity of the bay and the main, with soundings all exceeding 10 fathoms. With a variable wind we proceeded down George Water until 1 A.M. Tuesday, 28th July, when both wind and tide leaving us, we anchored in 10 fathoms (mud), in longitude E.  $124^{\circ} 34' 10''$ , latitude s.  $15^{\circ} 51' 35''$ .

*July 28.*—After a night of the most refreshing sleep, so well appreciated by us after our steamed and mosquito bitten nights on the Glenelg, we arose to see before us what we desired in the south-west corner of George Water; namely—a far wider, shorter, and from this distance we judge, a safer outlet to the sea than the south-east channel, by which we entered from Doubtful Bay. Sailed at 11.15 A.M., calm; at 1 P.M. a breeze sprung up, and we began to beat towards the south-west passage, but at 3.15 P.M., just as we had sighted a series of native fires close by the shore, a loud grating noise—whilst I was making entry of the last sounding  $\frac{1}{2} 5$ —and the sudden stoppage of the vessel showed us that we were aground on some rocks, where in a few moments the receding tide left us at an angle of  $30^{\circ}$ , on a comparatively flat rock with deep water on either side. The master of the vessel left in the long-boat to examine the south-west passage, and after dusk he

returned, reporting a deep and safe passage, not as I supposed, to seaward, but into Doubtful Bay, not very far distant from the south-east passage. Just before sunset the natives on shore lighted up many fires, and gave us a "cooee," but whether of friendship or defiance I know not; however, we returned the salutation in like form, and continued this pastime for an hour or so, hoping to entice them, if they possessed canoes, to pay us a visit. On the return of the long-boat the propriety of landing and tying up some presents (we had brought looking-glasses and other trifles with us for the purpose) to the trees was debated; but it was thought generally, that the articles, when found, might be taken possession of with the idea that they had stolen them from us, and that the idea of our leaving them there intentionally as presents, would involve too complex a matter for their understanding. When the tide suits, which will be about 9 P.M., the master of the *Flying Foam* purposes to sail down the newly explored channel, so it is very improbable the natives will see us depart. About 9 P.M. set sail from the rocks, but the wind failing, had to tow the vessel down the south-west channel. It was a much safer passage from Doubtful Bay into George Water than the south-east one. The soundings were equally good, and its width on an average twice that of the other, whilst there was no dangerous navigation at all to be compared to the northern extremity of the south-east channel. Two points shown in the chart were exceedingly rugged, and there were many parts of the shores precipitous and some cliffs quite perpendicular. We reached Doubtful Bay in half an hour after midnight, and after cruising for some little time in search of a wind, anchored s.s.w. (nearly) of the south-west passage into George Water.

#### COLLIER BAY.

*July 29.*—An immense whale (humpback) estimated at 6 to 10 tons, is sporting about the bay. From this anchorage the two mouths of the Glenelg appear to be in the positions indicated on Grey's chart, and the shores of the bay and adjacent islands to be moderately but not precisely correct. At 11 A.M. sailed with wind and tide into Collier Bay; the breeze lasted until after sunset and carried us well up into the bay, but then dropped and left us to the mercy of the tide, which drifted us back again to the entrance, from whence it is rather a pretty sight. It is a magnificent sheet of water; we sailed closer to the eastern shore than the western, as it was the wish of the party to land and examine the country sighted from Mount Lizard. What makes the bay so interesting as we sail along is the beautiful geological sections displayed every here and there by hills and cliffs; the distance of our course from the shore is too great to admit of more than a general recognition

of strata, but as I do not purpose accompanying the party on the preliminary exploration on foot, I promise myself a ramble along the shores, in the hope of an augmentation to my various collections. The country at the head of the bay is remarkably rugged : hills of very irregular conformation confusedly piled, with here and there a cone of graceful outline. Beyond all a lofty blue range towers over, whose summits are rent and split occasionally in a grotesque manner ; lower down towards the level there is now and then a cubical block of old red sandstone standing quite bare, and, viewed at a distance over half a mile, looking very like a red brick house. The soundings up to the present time have all been good, the leadsman having on no occasion called less than 12 fathoms, and very frequently no bottom at 15 fathoms. Drifted at 8.20 P.M. into 20 fathoms water, and there cast anchor for the night. The moonlight is exceedingly brilliant here ; some of our party seated on the deck have more than once enjoyed a game of chess by moonlight. This comfort of free exposure of face and hands to the cool evening air after the muffling up we had recourse to on the Glenelg, during the month of our river experience (this applies only to the river itself, mosquitoes being rarities in the bush a mile or so distant) becomes a boon we well know how to appreciate.

*July 30.*—At 6 A.M., left the anchorage of last night, and sailed till 8 A.M., when we anchored in Shoal Bay in 4 fathoms. Here the long-boat left with a crew of three, and three days' provisions, with a view to walk to some high hills and examine the country which appeared so promising from Mount Lizard. Some of those left on board landed on two of the islands for an hour or two's stroll in the morning. They found nothing worthy of note except an abundance of beans and numerous tracks of turtles. They noted well the spot, however, and intend to re-visit the place this evening in the hope of surprising one of these turtle visitors ; it will be acceptable to us as a change of food. Close to the turtle-tracks a vast quantity of fine beans grow ; they are now in every stage of development from the green pod to the perfectly ripe seed. So plentiful are they that we contemplate sending our spare hands who remain on board to gather some sacks full ; our stock of vegetables has long since been exhausted. They observed recent tracks of large parties of natives, who beyond doubt assemble on these islands to feast on the produce of the sea. A few corals and shells were brought to add to my collection. About 6 P.M., the gig, with a crew, went to the turtle-bank, but after waiting an hour or so returned unsuccessful. The long-boat party also returned ; the boat's crew had not taken sufficient provisions to last 24 hours from the vessel, and 12 of the biscuits of our land party were lost ; hence the return. They report the bay they entered as much larger than

laid down on the chart; it was the bay to the east of Shoal Bay. They also found a river running into the south-east corner of this bay, with the first wide reach running about south-east. They did not get into this river for the reason above alleged. From a hill on the southern shore of the bay they sighted a large sheet of water E.N.E., which they thought might be Doubtful Bay, but on marking the bearings on the chart, it would appear to be a large sheet of water which would be found close to the opening opposite to the anchorage of this morning. The country described agrees so far with our distant view of it from Mount Lizard. They brought with them three specimens of the native canoes, which are a step, and that only, in advance of the single log so frequently used by the Australian aborigines. They (the canoes—not the aborigines) consist of three or four mangrove-sticks, about 6 or 7 feet in length, pegged together with pine. The ends of all the sticks are carefully sharpened, and only such sticks as are naturally bent to a suitable shape appear to be chosen; about the middle of the canoe there is a pine pin projecting 6 or 7 inches on either side, probably affording a similar support to the native mariner as a stirrup does to a horseman. Of course there is no attempt to make a bottom to the canoe, nor do the specimens brought show the least sign of ornamentation. There is a red ochreous stain to be detected upon them here and there, but we account for them as having been communicated from the persons of the natives coloured with *wilgi*, or they may possibly have been designedly coloured with *wilgi* (red ochre). They also brought the first specimen we had seen of a *Hakea*, some few seeds, coral, and other natural objects, but nothing remarkably interesting.

*July 31.*—At 7 A.M., the long-boat, with an exploring party of six, taking with them a week's provisions, left the vessel to examine the river supposed to exist in the south-eastern corner of "Secure Bay," which latter is laid down in the charts about half its real size. One of our party and myself, an hour afterwards, left for the turtle islands; we were, as we expected, too late for the turtles, but their recent tracks upon the sand and their holes were numerous. At the upper part of the sandy beach there were the remains of an aboriginal festival. Many old fire-places, cracking stones, break-winds, the soft shell of many a turtle's egg, with fragments of a turtle's carapace, were noticed about the ground. Near our fire we observed a portion of a native canoe; it was the thicker end of one of the sticks, standing in the place of the ribs; from this specimen we suppose the natives to be in possession of sharp-edged tools, probably made from the same greenstone which they sharpen their spears with, because the end of the stick was formed by clean even cuts, with no sign of scraping; but as they do not require boring

tools, the mangrove-sticks being evidently chosen when dry and capable of being fastened by driving a sharpened pine peg through them, as a carpenter would drive a nail through boards, they seem to be unacquainted with the use of them. Moreover, the pine pegs drive easily through the dry mangroves, and it is only rarely we find the sticks split by the process. On the same sand-patch we found large quantities of the beans, whose creeping runners are of enormous length, some exceeding 40 paces. As the seed was nearly ripe I collected 1½ pint, and gathered a few of the green pods hoping to be able to dry and preserve them. Growing along with the beans was a convolvulus whose shoots equalled theirs in length; a small quantity of its seed I also preserved; we could only find one flower, and that not larger than that of *C. major* grown in England; its colour was of a purplish pink, with the usual deeper tinge of colours towards the centre of each petal. We then walked up a valley with a water-course having deep stony holes but no water, nor were there any palms to indicate permanent water even at a depth below the ground, so that we imagine the island to be surface-watered, and that alone. When the natives visit this island in the dry season to enjoy a turtle feast they must bring the water from the mainland in shells; for these latter we sought carefully but unsuccessfully.

The formation of the island is old red sandstone and free-stone, the latter of excellent quality; in one or two places the strata are vertical, but in general the dip is south at an angle of about 15°. Instances of *scoria* were occasionally met with, and between the water-marks, here 37 feet distant, the formation was evidently volcanic. The trees were not by any means stunted, the eucalypti attaining a height of 50 feet and upwards, but all gave evidences of occasional strong winds prevailing which caused the trunks to grow in anything but a straight line. The fact was the more apparent to us because we had noticed in the Glenelg district how very straight all the timber, from the smallest to the largest, grew. The grass was thin but of good quality. The surface of the ground being covered with loose stones we merely walked to the top of the hill, whence we enjoyed a magnificent view of Collier Bay and our good little vessel at anchor, a mere speck on the water. We then returned to the sandy beach and spent a couple of hours in examining the shells and corals; there were but few good shells, but the specimens of corals were numerous, and my collection included more than an average number of species. Foraminifera are rare in the drift-sand. Towards noon we returned to the boat; *en route* to the ship we espied, coming rapidly towards us, a dark object which from its direction of progress through the water we thought might

possibly be a native crossing the bay on his canoe. As the line of travelling of this object did not exactly coincide with our course, we at once steered towards it in the hope of at least witnessing the mode of propelling and guiding the singular craft used as a canoe. Great was our disappointment to find our native and his canoe to be only the roots of a large tree floating steadily, trunk downwards, through the water; nor was it a little provoking to find a white spot on the top, on which we had laid good stress in our predication, turn out to be a sea-bird perched there and enjoying a quiet sleep until the noise of our approach awoke him, made him stare a little at our intrusion, and then take to flight in utter consternation.

At dusk the long-boat and exploring party returned. They had passed safely through Secure Bay and entered the river passage, which is very narrow, has an island in the middle and perpendicular cliffs on both sides, and a tide which ebbs and flows with wonderful force; passing up the reach they had come to a second narrow passage of greater velocity and danger than the former. Here whirlpools were formed by the flowing tide, and only by the united strength of all on board was the boat prevented being drawn in; fortunately the passage was clear of rocks, for the velocity was estimated at 20 miles per hour, and of course the slightest check or impediment would have dashed the boat to pieces, and certain death alone would have stared the explorers in the face. This hurling of the boat through the second passage, as through a sluice, terminated in the discovery of a large sheet of water, equal in extent to George Water, bounded on all sides by mangrove banks and creeks. With difficulty effecting a landing, they ascended a high hill of a dark purple coloured granite, on which only scattered tufts of spinifex and stunted bushes grew, the rest was all bare granite boulders and fragments, to walk safely over which the greatest attention to the footing was every moment necessary. From the summit no view was obtained, save of numerous cones and bluffs of granite equally bare and difficult to walk over. The large sheet of water E.N.E. of Secure Bay was not again sighted. On consideration, it was thought prudent to return to the vessel at once and proceed to Roebuck Bay, as the corn and water on board the vessel would not last more than a month from the time we left the Glenelg, and to reach the country we sighted from Mount Lizard from this point would certainly make a sad inroad into the stock of provender and water, and these failing, nothing could be done save the killing and throwing overboard some, if not all, of the horses. Therefore, at 8 p.m., both boats were hoisted on board, and all made ready to sail from this bay, *en route* to Roebuck Bay, by to-morrow morning's tide. The tide here to-day rose 36 feet.

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2.—*Report for the Information of His Excellency the Governor of Western Australia, and the Promoters of the North-Western Expedition of 1864, on the Voyage and the Resources of the Districts Explored.\**

THE voyage from Champion Bay to the anchorage in Brecknock Harbour occupied 25 days, owing to a succession of light and contrary winds after passing North-West Cape. During this period two incidents only call for especial remark; namely, a visit to Bedout Island, and the discovery of a dangerous reef.

The visit to Bedout Island was resolved upon in consequence of adverse winds. From careful observations made, the position of the highest land seems to be in longitude E.  $118^{\circ} 56' 20''$ , latitude s.  $19^{\circ} 40' 45''$ ; according to the charts, longitude E.  $119^{\circ}$ , latitude  $19^{\circ} 36' 20''$ ; according to Norrie's list, longitude E.  $118^{\circ} 52'$ , latitude s.  $19^{\circ} 29'$ . These data show an extreme difference in the position of the island amounting to 8 minutes of longitude and 11 of latitude. Ships sailing in this direction, therefore, should approach the island cautiously. The island is about a mile in length; its mean breadth is half a mile. It appears to be formed as islands are usually formed in the centre of circular coral-reefs or atolls; it is merely a heap of coral-sand piled up upon a sandstone point of ancient elevation, whose dip is about  $15^{\circ}$  to the westward. This has gradually become clothed with soil capable of supporting a coarse and stunted vegetation. The rock forming the basis of the island is a trappean sand-stone composed of particles derived from the decomposition of greenstones and basalts, consisting chiefly of feldspar and horn-blende grains, devoid of external crystalline form, with which are mingled quartzose grains and mica-flakes derived from other sources. The diameter of the encircling reef is about 3 miles; the space between the reef and the island is not more than 6 or 7 feet below low-water mark, in any place. There was no water upon the island. The anchorage 3 miles to the southward of Bedout Island, in 6 fathoms at low water, is good. High tide at full and change of the moon occurs at 10.50 A.M. Rise of tide (spring) 24 feet. The island is at present the resort of pelicans and turtles.

On Thursday, the 29th of March, we sighted Caffarelli Island towards sunset, and sailed a course midway between that island

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\* This Report accompanied the narrative of a second expedition, in which Mr. Martin was engaged, in 1864, having the same objects as that of 1863, namely the discovery of new tracts of pastoral country in North-Western Australia. The commander of the expedition was Mr. F. K. Panter.

and the Brue Rock. But at 8.30 P.M., it being very dark and the weather threatening, we shortened sail; before this was quite accomplished we struck upon a reef. After striking, the vessel drifted into 25 fathoms water. At 8.45 P.M. the anchor was let go, with 60 fathoms of chain. Half an hour afterwards it became necessary to cast a second anchor, with 60 fathoms of heavier cable. During the night a gale from the S.S.E. gradually sprang up. At noon, on the 30th March, the smaller of the two cables parted, whereby we lost the kedge anchor and 70 fathoms of chain. The starboard anchor, weighing 12 cwt., with 60 fathoms of chain, dragged for about 30 minutes, when, just as the preparations were made to unshackle it and try what sails could do, it held; nor did the most violent bursts of the gale again start it. This reef is not laid down upon the charts. The point of the reef where we struck is between 5 and 6 miles from the westernmost point of Caffarelli; the island bearing E.S.E. The reef, on its northern and southern sides, is of a flattened horseshoe shape, and it extends as far as we can see towards Caffarelli. It is awash at three-quarter flood-tide. According to the charts there should be a passage of 14 miles here, between the Brue Rock and Caffarelli, with soundings from 15 to 25 fathoms.

#### THE DISTRICT OF THE GLENELG ; CLIMATE, EXTENT, PASTORAL RESOURCES, AND GENERAL CAPABILITIES OF THE SOIL.

Partially surrounded by sea and deeply indented with noble harbours, this district, so far as longitude E.  $125^{\circ} 15'$ , may be said to enjoy a sea climate. The two periods during which meteorological observations have been made are far too short to admit of any precise conclusions on climatological questions even with respect to the particular months during which they were recorded; but as they do not differ greatly from results which might have been predicated of the district, taking its geographical situation alone as argument, they may be of some slight value, although, doubtless, they will have to undergo many alterations and corrections hereafter. These observations, together with our experience of the weather and the appearance of the country, rivers, and vegetation, all confirm the supposition that there are two rainy and one dry season in the year. The first wet season commences about December, and as we find the country everywhere clothed with the richest vegetation of about a month or six weeks' growth, whilst young leaves of such trees as the eucalypti are parched with the sun, it is probable the first and heaviest rains end in February; to these succeeds a period of warm clear weather lasting until the

end of March, when the sky again becomes cloud-bearing, but at this season with thunderstorms only. The mornings of April were almost always cloudless, or with high cumulus and cirrus of small amount; but in the afternoon or evening dense banks of cumulus appeared generally upon the eastern horizon, working up against a westerly or sea breeze, and terminating nearly every day in a thunderstorm with rain. These storms rarely lasted more than an hour; they travelled quickly. In the months of June and July the sky is again cloudless, and the various grasses ripen slowly: the heat of the noonday sun being tempered by exceedingly heavy dews and cool sea-breezes. On one of the hottest days in July (19th), 1863, sitting in the sun or in the shade during midday bivouac was a matter of indifference, although the thermometers at the time stood at  $122^{\circ}$  in the sun and  $94^{\circ}$  in the shade, at a distance of 45 miles from the coast-line and at an elevation of only 200 feet above mean sea-level. This, the hottest season of the year, lasts until the heavy rains in December. During the latter wet and the succeeding dry seasons the mean temperature appears high; this is caused by the high readings of the minimum thermometers: they seldom register less than  $80^{\circ}$  in April and  $65^{\circ}$  in June and July, yet the nights rarely feel oppressive. Lightning to the east and north-east occurs nearly every night in March, April, and May. In June and July the days are bright and cloudless: the nights cool and refreshing. The health of the party has in no case suffered from climatic causes; slight inflammation of the conjunctiva has attacked a few who have been subjected to unavoidable exposure; there has been one case of diarrhoea, and one of dysentery,—both yielded to a single dose of chlorodyne; and one attack of fever, of a typhoid nature, which was successfully treated with quinine.

The mean atmospheric pressure, temperature, &c., is shown in the following Table:—

Date.	Mean Atmospheric Pressure.	Mean Temperature (shade).	Mean Maximum.	Mean Minimum.	Mean Diurnal Range.	Mean Solar Radiation.	Dew.	
							Mean Dew-point.	Mean amount of Dew, 1-10.
1863.								
June ..	Inches. 30·181	80·2	86·2	65·7	20·5	14·2	66·2	4·2
July ..	·061	83·3	91·8	65·3	26·2	22·9	63·7	3·3
Aug. 18	·153	74·7	78·5	66·	12·4	19·4	65·8	2·
1864.								
Apr. ..	29·989	87·5	90·4	78·1	12·1	20·4	79·4	2·2

The hygrometric conditions, &c., are detailed in the annexed Table :—

Date.	HYGROMETER.								Monthly Means.	Total Rain in Hours.	Mean daily amount of Cloud, 0-10.			
	9 A.M.		3 P.M.		9 P.M.		Wet.	Dry.						
	Wet.	Dry.	Wet.	Dry.	Wet.	Dry.								
1863.														
June ..	71·3	77·9	72·6	82·6	72·2	80·2	72·	80·2	1·7	2·12				
July ..	68·6	75·9	72·6	88·6	73·5	85·4	75·5	83·3	0·0	0·57				
Aug. ..	70·	75·2	69·9	75·5	68·4	75·7	69 4	74·7	0·28	2·8				
1864.														
Apr. ..	81·4	84·2	84·1	89·7	83·2	87·7	82·8	87·5	9·7	1·8				

The direction of the winds, reduced to eight points of the compass, and the force estimated by the Beaufort notation from 1-12 (observations being made at 9 A.M., 3 P.M., and 9 P.M.) are recorded in the Table subjoined :—

Date.	N.	N.W.	W.	S.W.	S.	S.E.	E.	N.E.	Calms.								
	No.	Force.	No.	Force.	No.	Force.	No.	Force.	No.	Force.							
1863.—June .	1	1	4	13·0	5	15·5	4	8·0	5	20·0	11	39	6	28	21	57·0	18
,, July :	1	1	5	5·0	5	13·0	1	0·5	2	3·0	2	3	7	27	54·5	47	
,, Aug. :	1	4	3	10·0	5	26·0	7	17·0	1	0·5	18	68	6	17	5	14·0	2
1864.—Apr.	5	7	10	24·5	21	30·0	4	7·0	4	8·0	5	6	4	4	8	27·0	29

Mean daily force of wind, 1-12—1863, June, 2·42; July, 0·5; August, 3·3; 1864, April, 1·3.

The extent of the known portion of the Glenelg district—that is, from the meridian of E. 125° 15' to the sea-coast, and from the parallel of S. 16° 15', to the latitude of Camden Harbour—includes only 2925 square miles; of which area, deducting one-third for stony ridges, an excessive amount, and the sea-inlets Doubtful Bay, George Water, &c., 1,000,000 acres are suited to the depasturing of sheep. Of these 1,000,000 acres, about 100,000 acres are adapted to the cultivation of rice and similar grain; 250,000 acres are especially favourable to the growth of spices, sugar, tea, and coffee; even cereals at high altitudes, and at certain seasons of the year, might be grown at any rate in sufficient quantities to meet the requirements of a pastoral and agricultural population. It is essentially a wool-growing country; it would be difficult to conceive a more luxuriantly grassed and watered territory; at the very lowest estimate it would carry a sheep to an acre, but in some picked spots there would be no risk in quadrupling that number of stock per acre, especially if sheep-farming were here practised with such intelligence as may be found in the tropical and subtropical districts of the Eastern Colonies of Aus-

tralia. The district, however, is neither fitted for cattle nor horses, except they be paddock-fed.

The islands westward of Brecknock Harbour, although quite as stony as the Glenelg district, are superbly grassed and watered. Augustus Island contains 56,000 acres of pastoral land, after deducting 0·4 of its whole area on account of the deep bays with which its shores are indented. Byam Martin's and Heywood's islands give 20,000 acres more. There are, therefore, about 80,000 acres of the richest pastoral land upon these islands, capable of carrying 80,000 sheep. All this country is so superior in grazing capabilities to the best districts occupied in the southern parts of Western Australia, that it is difficult to institute a comparison.

*Mineral Resources.*—Excluding building materials, the chief mineral resources are copper and iron.

1. *Copper.*—Indications of copper-lodes are to be met with in several parts of the Glenelg district; whether these lodes will be found hereafter to yield sufficient quantities to be profitably worked remains to be seen. Other specimens are collected than appear in the following list; but as the means of identification are not now to be obtained, their examination must be made at some future time :—

- a. Bornite—East base of Mount Lookover.
- b. Remolinite—Ditto.
- c. Lettsomite—Beach of Brecknock Harbour.
- d. Liroconite—Mount Double Cone.
- e. Sand containing *Erinite*, a dystomic Habroneme Malachite  
—Beach on Camden Peninsula.

2. *Iron.*—Hydrous oxides, veins of both crystalline and amorphous iron-ore, together with nodular masses of specular iron-ore, highly crystalline and of considerable size, occur abundantly throughout the district. In Brecknock Harbour, at the base of Mount Lookover, and in the summer bed of the Glenelg, vast quantities of these examples may be found; scarcity of manual labour alone can prevent these ores of iron from becoming an important resource to the Glenelg district when occupied. Titaniferous iron-sand occurs plentifully wherever the formation is either basaltic or sedimentary; it is even found largely predominating in soundings of from 10 to 15 fathoms, at a distance of several miles from the coast-line.

Of the existence of an extensive gold deposit there is no evidence. From the discovery of exceedingly minute particles in the mud of the Glenelg River, and from the finding of a single specimen of nagyagite, an auropbumbiferous telluret, search, if made, should be directed towards the source of the Glenelg River

and thence southward as far as the FitzRoy River and the "provincia aurifera" of the old charts.

Precious stones will not be found in sufficient quantity to be of economic value; indifferent specimens of topazes, sapphires, zircons, rubies, agate, &c., will reward the seeker in almost any streambed; more rarely beryl, chalcedony, porzellanspath, obsidiam, and flint, will be found.

*Building Materials.*—The principal building stones are basalt and sandstones of various kinds, micaceous, argillaceous, and pseudo-crystalline. The latter, as it has no tendency to split in one direction more than another, may be termed a freestone: it is nearly white in colour, and can be procured in vast quantities upon the surface. The argillaceous variety is a flagstone well fitted for street-flagging, steps, &c.; it would likewise be found effective in ecclesiastical architecture.

Limestone yielding lime for building purposes is found in several localities; the specimens obtained from the range of hills to the westward of George Water contain the highest percentage of lime. In the district of the Upper Glenelg there are fine varieties of crystalline limestone of the saccharine kind, together with large deposits of a true magnesian limestone of a pearly lustre. Until an accurate examination of the palaeontological contents and petrological relations of these limestones be made, their precise value cannot be more exactly determined.

*Indigenous Vegetable Productions.*—The following is a very imperfect sketch of the resources which the indigenous vegetation furnishes to this district. In grouping these according to the products afforded by them, the variety, abundance, colossal size of many and the durability of some, first attract the attention. By far the greater number of trees, valued for their timber, may be included among the Eucalypti, several species of which here attain a height but little inferior to the *E. globulus*, or bluegum-tree of Victoria. The flooded gum-tree (*E. rostrata*), the white gum (*E. acervula*), and the ironbark-tree (*E. resinifera*), are all to be found here in situations where, although too distant from the coast to export, they will prove invaluable to the future settler. Other species of Eucalypti, e.g. *E. aspera*, *ferruginea*, *citriodora*, *aurantiaca*, *phaenicea*,—besides their notable service in the bush as ample shade-givers, will all prove useful woods to the settler and to the artisan.

Upon the dividing ranges between the Prince Regent's River and the Glenelg, and in many other localities, the *Callitris verrucosa*, a pine not unfrequently met with throughout the interior of the Australian continent, from Victoria westward and northward to Champion Bay, Shark's Bay, and Arnhem's Land,—here, in the above-mentioned district, attains a size rendering it an object of

great value. It is fitted for all the usual purposes to which deal is applied in buildings generally, and it occasionally reaches dimensions that suffice for the making of masts and spars of moderate size. The wood is nearly of equal value with the well-known *Dammara australis*, or Kauri pine. Perfectly straight trees of the following admeasurements are common:—Circumference near the base, 8 feet; 5 feet from the ground, 7 feet; approximate height of the whole tree, 100 feet. Sir George Grey speaks of this tree (vol i. p. 275) as “fit for the purposes either of building or making spars for vessels;” he adds, “it is abundant and good, and could be readily and cheaply exported, if they were cut in the vicinity of the streams, and floated down to the sea in the rainy season, whereby all land carriage would be avoided.” This *Callitris* is frequently associated with the *Araucaria excelsa* on the higher ranges both inland and on the sea-coast.

A melaleuca, very closely allied to if not identical with the *Melaleuca leucodendron* of India, from whose leaves the cajeput oil of commerce is extracted, grows abundantly, and attains an enormous size. There are many other trees yielding timber in every respect suitable to the requirements of the cabinet-maker, whether of plain or ornamental works.

*Fruits.*—Amongst the edible indigenous fruits, those of the “quandang” or native peach-tree (*Santalum preissianum*) deserves first mention: the fruit, notwithstanding its thin pericarp and strongly acidulous taste, is grateful and largely available for food. Other fruiting bushes of the same order (*Santalaceæ*) yield berries of a pleasant flavour.

Three species of *Cissus* are found: two run along the ground or entwine amongst shrubs, the third is arborescent. All bear fruit in size, appearance, and flavour like the small black cluster grape, and in bunches from ten to forty. The Baobab-tree yields a drupe as large as a cocoa-nut: the pulp and seeds of this fruit are very palatable; the bark and spongy inner wood, when soaked in boiling water, afford an agreeable mucilaginous drink not unlike maccaroni in taste. These trees attain an enormous diameter (50 feet in one instance), but they rarely exceed 25 feet in height. The young leaves and seeds of the palm fruit are of an excellent flavour: when green the seeds or nuts are not dissimilar to the English filbert.

*Native Vegetables.*—Amongst the indigenous plants available as culinary vegetables the fine bean, which grows so abundantly on the sand-hills of the coast, offers, when boiled, a nutritious diet: as a species it is as yet unnamed. The pea, *Abrus precatorius*, is plentiful all over the district: its valuable properties as a legume are recognised even by the aborigines. Horses eat greedily the branches, ripe seeds, and leaves. Several herbaceous members of the small family *Basellaceæ* may be regarded as a substitute for

spinach. The amylaceous roots of the *Dioscorea*, "warrein," and *Typha*, "yun-jid" or "adjico," are here, as in the southern parts of Western Australia, important articles of vegetable food of the natives.

*Fibres.*—The lemon grass, *Anatherum schænanthus*, is pretty generally distributed throughout the district: this and one of the Liliaceæ, not unlike a dwarf *Phormium tenax*, yield a fibre from which the aborigines manufacture a strong and well-made twine. But of all the indigenous fibre-yielding leaves that of the palm deserves especial examination: it is a species of *Livistonia* growing in or near to every stream; its leaf, even if the fibre prove useless for cordage, will be valuable for the manufacture of hats, umbrellas, &c., suited to the climate. It might even be employed in the making of any coarse kind of paper.

*Medicinal Plants, Gums, &c.*—In this division of the indigenous vegetable productions, little can be safely predicated until opportunity has been afforded for an investigation into the medicinal properties of the plants already discovered; which, doubtless, form a very inconsiderable number of this class within even the limited area explored. The abrus and the anatherum, the pea and the lemon grass, as of most frequent occurrence, may be considered first. From the roots of the former we expect a perfect substitute for liquorice in every respect; from an infusion of the leaves of the latter, we know, from Indian experience, we can obtain a tea acknowledged to be stomachic, tonic, and useful in dyspepsia. From the convolvulaceæ, one species of which is included in the genus *Ipomæa*, we may extract deoretin, affirmed to be identical with jalapin; from a second species, of the genus *convolvulus*, scammony or a cathartic resin of equal value may be prepared from the expressed juice of its roots and stalks. From the root-stocks of the *typha*, extracts astringent and diuretic are obtainable. An elastic gum, something like Indian-rubber, and gum tragacynth, have been found. Sandaric resin can be procured from the pine and gum-resins of various descriptions from several of the eucalypti.

The bark of some of the trees indigenous to this district will yield a tonic and stimulant, depending on the presence of an alkaloid, which there is every reason to believe will make them become an article of export ere many years. The unlimited quantities of the *melaleuca* may be expected to produce an oil not inferior to the cajeputi oil extracted even by the simple Indian process. There are but few genera of the myrtaceous trees and shrubs from whose leaves and flowers we fail to extract a greater or lesser quantity of essential oil—aromatic, volatile, though somewhat camphoric.

As perfume plants the *Chamaelaucieæ*, the *Rutaceæ*, and the *Labiaceæ* abound in species; but to what extent they will prove of value for perfume distillation is difficult to foresee. Lastly, the

*Acaciæ*, producing flowers in the utmost profusion (especially the large species fringing the upper Glenelg and nearly all the fresh-water streams of the district), possessing such powerful and agreeable odours, may be indicated as proximate objects of commercial value when this luxuriant country shall become the home of an intelligent people.

*Animal Products.*—To the geological character of the land its almost universal pre-oolitic fauna may be traced. Here, as elsewhere throughout the Australian continent, the pouch-bearing mammals, Marsupiata, rank next to man, so far as the development of their physical organization is concerned. These native animals, particularly the larger species of the Macropidæ, are extremely numerous in the Glenelg district: the skin of the *M. major* and the *M. laniger*, or large red kangaroo, as well as the skins of the smaller varieties, will form no mean item in the resources of the early settlers; whilst these fur-clad skins are regarded as articles of commerce, the value of the carcase of the animals, as excellent meat, must not be wholly ignored.

Of birds, which are numerous both as to species and individuals—the emu, geese, ducks, the native turkey (*Otis Australasianus*), the “ngowoo” or native pheasant (*Leipoa ocellata*), the jungle-fowl (*Megapodius tumulus*), the lyre bird (*Menura superba*), and very many others, may be mentioned as valuable either for their flesh, brilliant plumage, oil, or eggs.

The waters of the district, both fresh and salt, are rich in products which await enterprise alone to raise them. Foremost amongst these ranks the dugong (*Halicore*), a marine herbivorous animal included in the Cetacea, observed in both Doubtful Harbour and Camden Sound: its flesh alone, which is not unlike beef, would make it a welcome visitant; but regarded as the source of an invaluable oil, superior in a nearly twofold ratio to the best cod-liver oil, its annual visit would give rise to a fishery attended with greater profit, outlay and other things being taken into account, than that of the sperm oil. The pearl oyster of commerce, the species valued for its nacreous substance, is undoubtedly to be found here plentifully, for the aborigines who would not be likely to undertake any excessive labour to procure them, very commonly wear them as an ornament suspended round the neck. The *Tridacna*, a conchiferous mollusk, found upon any point of the coast between North-West Cape and the Prince Regent's River, might be included in the pearl-oyster fishery; for although its shell has no valuable nacreous lining, in it pearls of great beauty and of considerable size are not unfrequently obtained. The trepang fishery could not be profitably carried on by Europeans. Whales and seals have been more than once seen within the harbours of this district. There are fine beds of oysters for the table in Brecknock Harbour: turtles,

crabs, cray-fish, &c., abound. Deep-sea fishery would in all probability be a profitable occupation. The fresh-water streams teem with fish of large size and of excellent flavour.

*Harbours, Rivers, and Internal Communication.*—The district of the Glenelg is especially rich in bays, river-harbours, and sheltered anchorages. Along its western shore, from Collier Bay to Camden Sound inclusive, a vessel may at all times select a safe position with good holding ground in 15 fathoms water, and shelter from either the islands or the great coral-reef known as Montgomery Shoal. Doubtful Bay into which the Glenelg flows after receiving the Gairdner and the Fish Rivers, both considerable streams, and almost an innumerable host of minor tributaries, any one of which in the settled districts of Western Australia would be called a river—is a magnificent sheet of water, 9 miles in length from north to south, and 6 miles in breadth from east to west. Although in the summer vast quantities of water may from all sides pour into the bay, and the tides gain additional force thereby, yet as it is thoroughly protected from every wind and from a heavy sea by a range of islands and reefs to seaward, and the natural breakwater of the Montgomery Islands and the coral-reef, 14 miles still further to the westward,—as the holding ground is of the very best,—and as there is an abundance of room in which to work the largest ship,—Doubtful Bay, when this portion of the Australian coast is colonised, will prove a harbour of refuge second to none. From the great rise and fall of the tide also, 36 feet, this bay is a good site for works necessary to the repairing of ships. A better terminus to the system of Australian telegraphs, when connected with those of Europe and Asia, it will be difficult to find. About the centre of a large mangrove-swamp on the eastern side of the bay, there is a red conical hill, which vessels entering by "Foam Passage" should get in a line with the centre of the passage; at a distance of 2 miles westward of "Foam Passage," the summit of the red cone will just appear above the horizon within the bay (bearing true east by south); this course should be kept for  $2\frac{1}{2}$  miles within the bay when Success Channel, the western entrance into George Water, will bear due north. The anchorage is safe anywhere within the bay; but in the vicinity of the spot indicated by the above bearings, a vessel at anchor will feel the tidal effect to a much less degree than elsewhere. There is but one known shoal within the bay, and that is situated at a distance of 4 miles from the red cone, on a line bearing N.  $31^{\circ}$  W. from the hill. At spring-tides this sand-bank was seen dry at low water. Soundings through "Foam Passage" and to the anchorage recommended are not less than 10 fathoms at low water; sand and mud bottom. Wood and water are to be had without difficulty in Doubtful Bay.

Brecknock Harbour, area nearly 20 square miles, is so thoroughly land-locked that a ship once at anchor, need fear no wind. The coast line within the harbour is everywhere indented with beautiful bays. There are several picturesque islands, on nearly all of which there is fresh water; every valley of the main has its rippling brook of the purest water running down to the beach. Ships entering from Camden Sound have but two dangers to avoid; one is the bank extending northwards from the pinnacle rock,—the other is the rocky bar between Careening Island and the circular reef. Until further surveys have been made, Roger's Strait is considered a very dangerous entrance on account of the reefs, and Camden Harbour a hazardous anchorage by reason of its terrace-like bottom, which at some tides has not more than half or three quarters of a fathom of water. Brecknock Harbour is an excellent place for watering ships, and drift-wood is abundant near the line of high water; but timber, fit for spars and the repairs of ships, grows at too great a distance inland to be available.

Vessels entering from Camden Sound should do so only with the flood-tide and with a fair wind; the rocks to the south-west of New Island, to be seen at all times, may be passed in mid-channel; but on sighting the Pinnacle, which is close to the southern shore, a course about one-eighth of a mile distant from New Island will command the deepest water, running from 13 to 14 fathoms at the narrowest part of the entrance; when the Pinnacle bears south, a course E.  $10^{\circ}$  N. may be sailed for  $2\frac{1}{2}$  miles, when the northern entrance opens out into Camden Sound, bearing north-west, all bearings true; thence, a course E.N.E. of 3 miles may be steered, with 6 and 7 fathoms of water, either towards Green Island or Camden Harbour. Vessels above 100 tons register may select any spot within these limits, and obtain safe anchorage. Vessels of less than 100 tons register, with a draught of about 10 feet, after crossing the rocky bar north-east by north of Careening Island, may find a perfectly secure anchorage, anywhere in mid-channel, as far as the entrance to Camden Harbour, with not less than 3 and 4 fathoms of water; all these soundings are at low tide. For beaching a vessel on a soft bottom, it would be difficult to find a better spot than the sand-patch on Careening Island; whilst if a hard even bottom be desired, for repairs of keel, &c., the deep bay whose head bears south-east from Mount Lookover, distant half a mile from the base of the mount, will be found convenient and safe. The time of high water within Brecknock Harbour, at full and change of the moon, or the Establishment of the Port, is at noon; that is 40 minutes later than in Camden Sound. Spring rise of tide 30 feet; neap, 12 feet. The tides rush through the entrances with great force; it would not be

advisable for any vessel to attempt the passages under sail, with an opposing tide.

"Success Channel," the north-west passage from Doubtful Bay to George Water, is safe for vessels of any draught, provided the flood tide be made use of; and anchorage in George Water or Maitland Bay is good; thence, to the lower rapids of the Glenelg, distant 40 miles from "Foam Passage," the river Glenelg may be described as safe and easy to navigate with cargo-boat or small steamer. Above the rapids cargo-boats might ply, for fully half the year, to a distance of 25 miles; but this last-mentioned navigation would be uncertain between the months of May and November. The Gairdner and Fish Rivers have a tide of not less than 10 feet; water communication to a limited extent, therefore, could be depended upon in these rivers for the same period as in the case of the upper Glenelg.

With regard to the internal communication of the district, it will suffice to state that there would be no great difficulty in the construction of roads: but lines of railway would in several directions entail great engineering difficulties, owing to the naturally precipitous character of the hills, and deep stream-beds of the rivers and gullies.

#### THE DISTRICT OF ROEBUCK BAY; CLIMATE, EXTENT, PASTORAL RESOURCES AND GENERAL CAPABILITIES OF THE SOIL.

The country explored to the eastward of Roebuck Bay between the  $17^{\circ}$  and  $18^{\circ}$  s. lat. and along the sea-coast from the head of Roebuck Bay to Cape Latouche Treville, although only 150 miles to the southward of the Glenelg district, offers a remarkable contrast in point of climatic phenomena. The mean temperature in the shade is here only  $6^{\circ}4$ ' lower than in the Glenelg district, and the solar radiation 50 miles eastward of the sea-coast, although generally  $5^{\circ}$  lower, is occasionally a few degrees higher; nevertheless the amount of humidity in the atmosphere is here very greatly decreased. In this month, May, the weather is found to resemble that of the Glenelg District in July. Clear cloudless days and nights prevailed, and only such winds, a few miles inland, as serve to keep the air in a perceptible motion; so that the days, although the thermometers read high, are not so warm but that a man can walk 20 or 30 miles without inconvenience from the heat; on one occasion, indeed, our exploring party walked 45 miles of course between the hours of 6 A.M. and 9 P.M. The annexed meteorological tables will in part account for this. The dryness of the atmosphere is like that of the Champion Bay district in the month of October or early in November, when a man can work eight or ten hours of day in the open air without suffering on

account of heat. May seems to be an early spring month : the trees are just coming into flower and the grass is everywhere green ; the natives take considerable trouble to burn their hunting grounds to entice the game with young feed ; but so speedily does the grass grow again, that in a few days the burnt place is once more green, before the ash of the former grass has been displaced by wind or showers. For nearly a week before the party landed, showers were occasionally seen to fall over various parts of the country, but during the period of the land exploration no rain fell. There was more or less dew every night, but an hour after sunrise it had all disappeared.

The mean atmospheric pressure, temperature, &c., for the month of May, from the 1st to the 23rd inclusive, is shown in the following Table :—

Date.	Mean Atmospheric Pressure.	Mean Temperature (shade.)	Mean Maximum.	Mean Minimum.	Mean Diurnal Range.	Mean Solar Radiation.	Mean Dew Point.	Mean amount of Dew. 0—10.
1864. May	30°139	81°1	85°7	69°6	15°7	15°2	71°8	1°2

The mean hygometric conditions, &c., will be found in the annexed Table :—

Date.	HYGROMETER.								Total Rain in Hours.	Mean Daily Amount of Cloud. 0—10.		
	9 A.M.		3 P.M.		9 P.M.		Mean for the Month.					
	Wet.	Dry.	Wet.	Dry.	Wet.	Dry.	Wet Bulb.	Dry Bulb.				
1864. May	72°1	78°2	76°7	83°1	77°3	81°8	75°6	81°1	0°	0°91		

The direction of the winds, reduced to eight points of the compass and the force estimated by the Beaufort notation, observations being made at 9 A.M., 3 P.M., and 9 P.M., are recorded in the Table subjoined :—

Date.	N.		N.W.		W.		S.W.		S.		S.E.		E.		N.E.		Mean daily force of Wind. 1—12.	Calms.
	No.	Force.	No.	Force.														
1864. May	0	0	3	5	6	10	7	14	1	2	27	73	12	16	3	4	1°79	10

The extent of explored country within the limits already mentioned as far eastward only as the meridian of 123° includes an area of 3300 square miles ; but from what has been seen at the

most distant stations from our dépôt, there is every reason to believe that the same kind of country extends eastward at least as far as the Fitzroy River, in long. E.  $123^{\circ} 30'$ ; and southward we know not to what extent. The known portion, however, contains 2,112,000 acres of perfectly level country,—so level that with the exception of the sea-coast range of sand-hills and three little hummocks near Cape Villarêt, no spot traversed eastward from the dépôt exceeded 50 feet in altitude. Of these 2,112,000 acres, perfectly level, well-grassed and almost treeless plains occupy 80,000 acres, the one-half of which lie round the south and east shores of Roebuck Bay, and the remainder inland from or east of Lagrange Bay. These plains possess chiefly an alluvial soil capable of growing many tropical productions; they are fringed with belts of moderately large Cajeputi trees. In the native wells, which are found on these plains at intervals of not more than a mile, water is obtainable within 16 or 18 feet, whilst within the belt of Cajeputi trees it is found plentifully within 4 or 5 feet of the surface. The rest of the country consists of grassy plains with shrubs and small timber chiefly of the order Myrtaceæ, sub-orders Chamælaucieæ, Leptospermeæ, Myrtleæ, not growing so thickly as to impede rapid riding except where thickets occur. These thickets are rather difficult to traverse on account of the mass of dead wood, the accumulation of years, not because of the density of the vegetation; once burnt thoroughly, as thickets they would disappear. The grass is fine, sweet, and plentiful; our route crossed no sand plains or barren places; in May the grass averages one foot in height, and it is quite green. A distinguishing feature between the grass of the Glenelg District and that found here must be mentioned, as upon it is based the comparatively low estimate of sheep-grazing capability. The grass grows in *tufts*. (This is also the case in certain highly valued parts of the already settled districts of Western Australia.) For this reason, as it is as well to under-estimate the carrying capability of a newly discovered country, a deduction of *one-half* its supposed carrying power is now made, although it is more than probable that the experience of the future settler will declare the amount to be greatly underrated. This premised, the known parts of the Roebuck Bay District, within the limits already mentioned, may be safely asserted to be capable of carrying upwards of one million of sheep.

No evidence of mineral resources was discovered in sufficient quantities to warrant more extended research. Building materials do not abound. The indigenous vegetable resources are very similar to those already named in reporting of the Glenelg country. The Baobab, palm, and pine do not occur here, and the timber generally can only be described as affording an ample supply of

firewood and an inferior material for fencing. With respect to perfume plants, however, the whole district is particularly rich. Nearly every tree and plant in flower yields a strong and grateful odour; the dwarf myrtle, so common here, perhaps, has the most powerful odour; but some of the acaciæ and small shrubs possess scents exquisitely beautiful. The perfume of the heliotrope, the violet, the clove pink, the rose, the stock, were all recognised; but many others, although delicious, were such as could not be likened to that of any commonly known plant or flower. Such animal products as are found here are already included in the list given of those within the district of the Glenelg.

*Harbours and Internal Communication.*—Roebuck Bay was well explored by Mr. Arthur Du Boulay, during the absence of the expedition inland. Six days were spent in its examination. It is a sheet of water at high tide extending 15 miles inland and having an opening from Cape Villarêt to the opposite coast of Dampier Land of no less than 22 miles; but if a line be drawn from Cape Villarêt to Point Gantheaume, the land dry at low water is at no point distant more than 4 miles from that line. The bay is thus reduced for the purposes of navigation to a trifling indentation of the coast line not exceeding an average breadth of 2 miles at the most. The whole of this is very shallow, 3 fathoms at low water, with the exception of a narrow channel running parallel from Cape Villarêt along the south-east shore of the bay. At a distance of  $1\frac{1}{2}$  mile to the north of Cape Villarêt this channel has a depth of 12 fathoms, but on tracing it up the bay it is found to shoal rapidly and ultimately disappeared at  $6\frac{1}{2}$  miles in a north-east direction. If a line due north from Cape Villarêt be drawn, after crossing the narrow channel just mentioned, for 20 miles extensive shoals are formed which give in no instance deeper water than 4 fathoms upon that line. The anchorage, however, in or near this deep channel is good and the ship is protected from the strong south-east breezes by the sand-hills of the coast; nor is it found a bad anchorage during south-west, south, east, or north-east winds. No strong wind has yet been registered from the west, north-west, or west. Only one detached rock, dangerous to shipping, has as yet been seen, and that is situated off Cape Villarêt, at a distance of about 1 mile north by west from the beach at the foot of the Cape; it is well above water at low tide. The bay has a series of fine sandy beaches from Cape Villarêt in a north-east direction for 12 miles; to these succeeds a mangrove fringe, attaining its greatest density and breadth at the head of the bay. High water at full and change occurs at 10 A.M. Spring-tides rise  $23\frac{1}{2}$  feet; neap-tide 12 feet.

Lagrange Bay as a harbour is of still less value than Roebuck Bay. It is only an indentation of the coast line to the extent of

4 miles at the deepest part. Viewed from the high land on Cape Latouche Treville it appears to be shallow. There was no opportunity to obtain soundings in Lagrange Bay. From the hammock on Cape Latouche Treville, whose summit is 180 feet above mean sea-level, an excellent view of the bay was obtained extending all round its coast line to Cape Bossut and Casuarina Reef. No considerable stream, perhaps not a creek, falls into the sea by this bay.

Throughout the country explored in this district there is an entire absence of rivers and even creeks, except a number of very short ones between Cape Villarêt and Cape Du Boulay. Land transit, however, is exceedingly easy, for the country is perfectly level; the soil, at a greater distance than 2 miles from the sea coast, is a red sandy loam without stone and only rarely showing a very fine gravel upon the surface. It is sufficiently hard for heavy drays to traverse it in any direction: nor does it seem likely to cut up much with continuous traffic.

Summary of pastoral and other lands explored on the North-West Coast:—

	District.			Area in Acres.	Estimated carrying capabilities (sheep).	
Glenelg .. .. .. .. ..				1,000,000	1,000,000	
Augustus and other islands .. ..				80,000	80,000	
Roeback Bay .. .. .. .. ..				2,112,000	1,056,000	
Dampier Land (?) .. .. .. .. ..				2,400,000 (?)	1,200,000 (?)	
<b>Totals .. .. ..</b>	<b></b>	<b></b>	<b></b>	<b>5,592,000</b>	<b>3,336,000</b>	

The following Table shows the direction and the force of winds experienced on the coast between Champion Bay and Camden Sound:—

Date.	N.		N.W.		W.		S.W.		S.		S.E.		E.		N.E.	
	No.	Force.	No.	Force.												
1863.—June . .	1	1·0	4	13	5	15·5	4	8	5	20·0	11	39	6	28	21	67
" August . .	1	4·0	3	10	5	26·0	7	17	1	0·5	18	68	6	17	5	14
1864.—March . .	2	11·0	3	4	4	7·0	14	66	2	5·0	20	79	5	14	7	23
" May 24 to { June 5 . }	2	11·5	2	15	4	22·5	1	5	0	0·0	20	86	4	15	6	34

#### THE ABORIGINES OF THE DISTRICT OF ROEBUCK BAY.

The tribes of natives in the interior excel those of the sea-coast in bodily structure. They are more muscular, taller, and appa-

rently more intelligent ; at any rate, the expression of their countenances is more pleasing : some of those we met had a profile more resembling that of a Polynesian, or a Kelœnonesian of the first division (New Hebrides, &c.), rather than that of the second division to which the Australian belongs. Of the form of the head (it is an argument from the particular to the universal, for my data are founded upon the examination of the only human skull discovered during the exploration inland),—it is as well perhaps here to give the chief particulars. The facial angle, as indicating the proportions of the cranial cavity and the grade of intelligence, contrasts very favourably with that of the lower types of the Australian native ; whilst this angle of the latter is included within an arc of  $85^{\circ}$ , that of the skull before me measures  $94^{\circ}$ , or only  $1^{\circ}$  less than the average facial angle of the European. The occipito-frontal diameter measures 7.23 inches ; the inter-parietal 5.81 inches ; the vertical height from the glabellæ-occipital line 4.5 inches ; from the level of the glabellæ-occipital line on each side, across the middle of the sagittal suture to the same point on the opposite side 11.75 inches ; the longitudinal arc from the nasal depression along the middle line of the skull to the occipital protuberance 13.1 inches ; the horizontal circumference in the plane of a line joining the glabella with the occipital protuberance 20.7 inches. The walls of the cranial cavity are less thick than in the skull of an adult aboriginal of the southern parts of Australia. The malar bones are prominent ; the zygomæ make a wide curve outwards, giving breadth to the face. The upper jaw is so prognathic as to give a very oblique insertion of the teeth.

The eyes of the inland aboriginal are black, and set very deep ; the nose in some is a great deal flattened ; the nostrils in a few instances were observed to be larger laterally than forwards ; the mouth exceeds the average size, but, generally, was well formed, and without the usual accompaniment of thick lips. The chin is of proportionate size, neither long nor broad. The lower part of the face is prominent ; the teeth are beautifully even and white. The hair, when allowed to grow naturally, appears in spiral locks about three or four inches in length, spreading out all over the head ; its texture may be described as wavy-crisp or frizzled, not strongly ; and its colour is what is generally styled a jet-black. The prevailing fashion in both sexes seems to be, to allow the hair to grow long and then to gather it all smoothly to the back of the head, and there tie it in a knot about the size of a cricket ball. No instance was seen of the addition of colouring or oleaginous matters as beautifiers of the hair. The moustache and beard are about equally abundant ; these possessions seem as much treasured as coveted : some who rejoiced in them carefully bound the beard beneath the

chin with a wrapping of string, others trained the moustache into a horizontal spiral after the fashion of the King of Italy ; others again whose upper lips were deficient in quantity of hair, wore *false hair*, that is, they supplemented that deficiency by a piece of dark-haired opossum skin, cut to the required shape.

In colour these natives are decidedly *black* ; as black as we might expect to find a people in a locality elevated but a few feet above mean sea-level—with large tracts of alluvial soil—and near enough to the equator to feel the influence of the moister character of tropical heat. There are, however, two shades very distinctly marked, like the blonde and brunette of the white race ; in one of these shades a bluish hue predominates, in the other the colour might be described as a reddish black.

These natives of the interior wear no clothing whatever, and their shelter from the cold and rainy weather seems to be of two forms : first, a hut of the rudest description, made of a few boughs piled loosely together, affording but little shelter from either wind or rain ; and secondly—an arrangement somewhat more complicated but equally defective—a platform of brushwood laid evenly to a height of about one foot above the ground, beneath the centre of which a circular hole wider at the base than at the top, is scraped out of the soil, deep enough and of sufficient size to contain the persons of one or two individuals coiled up, as it were, beneath the overhanging sides of the cavity.

This kind of habitation is used, doubtlessly, in dry but cold weather ; when it rains, it is probable they make use of the platform of sticks above the hole, as a sitting or reclining place ; it would answer to keep them from the wet earth and that is all. For the greater part of the year, their primitive hut would suffice in exposed situations, if protection of any kind be needed ; but during the periodic tropical rains these people, resident in a level country where no cave or other natural shelter is at hand, must practice no mean amount of patient endurance. They seem, nevertheless, to attain a good old age, in spite of privations and exposure ; we fell in with several old men and women who had evidently lived many summers more than fall to the lot of Australian natives in general.

Foremost among the ornaments in common use by these people ranks the pearl-oyster shell of the coast. The centre of this shell, that is, so much of it as can be ground into an oval shape whilst retaining the nacreous substance very nearly flat, is either worn plain or engraved. In the manufacture of these plain ornaments, nothing more is required than the grinding away of about two-thirds of the entire substance of the margin of the shell, the drilling of a hole through it near one end of the smaller diameter, and the sus-

pending of the shell by one or more thicknesses of the native string. But the more valued ornament, after passing through the processes enumerated, has its nacreous surface completely covered with a lace-like pattern composed of four and five sided figures, combined in a very curious manner and included within one or several parallel elliptical lines running equi-distant from the ground edge of the shell. These figures composed of three or more series of the lines, are engraved to a depth of about .025 of an inch ; then the spaces are filled up with a black pigment, a mixture of gum and charcoal. Amongst the minor ornaments examined may be mentioned a necklace made of the claws of a crab (*Porcellana*, a genus of anomurous crustacea found only occasionally on the north-west coast of Australia) : the pieces composing the necklace were about the size and shape of large bugles, similar to those used in ladies' fancy work ; and a hair-pin made out of a kangaroo's tooth—an incisor of the lower jaw of one of the larger species of *Macropidæ*. These natives are as fond of personal decoration in plastic colours done in small round spots upon the legs, arms, and upper parts of the body, as other Australian tribes. Some years ago, at a famous native festival in south-west Australia, several men were painted round the neck in imitation of the then fashionable ladies' lace-collars, with lappets down the breast : this was very neatly executed with a white paint made of pipe-clay, laid on in minute spots with an extempore brush ; this kind of painting we also noticed in the case of an individual amongst the group we first met in the interior, but the colouring included four tints and extended down to the feet in a harlequin-like pattern.

As this race of people have no rivers or deep-sea inlets to cross, the craft already described as commonly used by the natives of the Glenelg district is of rare occurrence here. The instrument of most general utility is in the form of a scoop ; with this they dig wells, and the indigenous roots used as food ; it is their basket and portmanteau : their water-jug and shovel. It is of very varied size and shape, both these latter depending upon the elbow of the tree from which it is cut ; so important an instrument is it, that as a rule it receives the highest possible degree of ornamentation ; it is carved, sometimes inside and outside, with closely adjoining parallel lines, disposed in a zigzag pattern. Some of the larger scoops are not carried from place to place with the tribe, but left beneath some bush in the neighbourhood of a well : these larger instruments are those which receive the maximum amount of decoration. For cooking purposes they use large shells, species of *Strombus* and *Triton* ; (the seed of the mangrove undergoes a most elaborate process in its preparation as an article of food). They also make bags of kangaroo skin, fastened with a twine made of the fibres of

an Anatherum, and a species of the Liliaceæ; a kind of twine is also made here of a mixture of opossum hair and vegetable fibre; another kind, which was found in use only as a means of suspending the engraved shells, was made of human hair alone.

These natives do not seem to be acquainted with the use of the womera, or throwing-stick. The spears we saw with each tribe or party we presume to be hunting-weapons; these are ill-shapen and not barbed; in some cases they were pointed at both ends; in every case they were intended to be thrown by the hand from the middle: some natives carried bundles of small spears only 3 feet in length; these were no doubt designed to spear small birds, whilst the thrower was in ambush. The usual stone hatchet of the Australian native is everywhere found on this coast. The kiley, however, is a superior instrument to that used by the aboriginal of the southwest coast; its shape more nearly approaches the bomerang of the Eastern Australian: but it is not so effective an instrument either in war or in the chase; both the kiley and the bomerang of Australia are instruments as inferior to that used by the ancient Egyptians as their weapon was inferior to that of the Assyrian huntsman. But notwithstanding the inferiority of the kiley of these natives, it is a weapon in their hands worthy of attention in an engagement; on a shield obtained, there were several indentations made by the kiley. The shield alluded to differs from that common to southern tribes in being cut out of the solid; it has a handle with a sufficient space for the hand of the holder also cut out of the same solid piece. Although heavy, it seems to have done the original owner good service in warding off blows from the kiley in its bizarre and rapid flight.

As concerning the natives of the sea-coast, it will suffice to state that they are inferior to the natives of the interior in physical development; they are less cleanly in their persons and less industrious in the chase. The same extraordinary mutilation, referred to by the officers of the *Beagle* when describing the sea-coast tribes of this district (Stokes, vol. i., page 117) was observed by members of our expedition; but the custom does not extend beyond the tribes of the coast.

The language of both sea-coast and inland tribes, judging from a limited vocabulary of about seventy words, is agglutinative, with Malay affinities few, obscure, and only partially recognised; the dialects prevail over exceedingly small areas, as is the case with eastern Kelœnonesian tribes. The following vocabulary, in the construction of which the Italian vowel sounds\* are adopted, will serve to illustrate these remarks:—

\* The vowels marked with a grave accent are long, those with an acute are short.

English.	Sea-coast Tribes.	Natives of the Interior.
Acacia .. .. .. .. .. ..	Írooal.	
Aut .. .. .. .. .. ..	Winbordo.	
Arm (from shoulder to elbow) .. ..	Kondaléé.	
Arm (forearm) .. .. .. ..	Míarra.	
Baby .. .. .. .. .. ..	Bábá .. .. ..	Bábí.
Bad (or useless) .. .. .. ..	.. .. ..	Málo.
Bean .. .. .. .. .. ..	.. .. ..	Wongarámi.
Beard .. .. .. .. .. ..	Moolguh.	
Boat .. .. .. .. .. ..	Kaila (Kyla).	
Boomerang, to thrown the, <i>v.</i> .. ..	Langi .. .. ..	Minduro.
Child, singular or plural .. .. ..	Irgalleh.	
Claw (of a crab) .. .. .. ..	Bábá.	
Clyanthus .. .. .. .. ..	Nímallah.	
Crab .. .. .. .. .. ..	Woolgah.	
Dog .. .. .. .. .. ..	Wangadah.	
Dowak (a weapon of war) .. .. ..	Yeeli .. .. ..	Elli.
Ear .. .. .. .. .. ..	Wallhalbidì.	
East .. .. .. .. .. ..	.. .. ..	Barboo.
Eyes .. .. .. .. .. ..	Kourrlah.	
Finger (1st phalanx) .. .. .. ..	Nímargo.	
,, (2nd phalanx) .. .. .. ..	Nurrah.	
,, (ungual phalanx) .. .. .. ..	Nillidì.	
Finger nails .. .. .. .. ..	Dìdah.	
Fire .. .. .. .. .. ..	Jöongo.	Kambo.
Firewood (fuel) .. .. .. ..	.. .. ..	Bidah.
Food .. .. .. .. .. ..	Níwáhl .. .. ..	Yarrawell.
Foot .. .. .. .. .. ..	Binderah.	
Girdle .. .. .. .. .. ..	Ninbah.	
,, tassel attached to .. .. .. .. ..		
Good (I understand, &c.) .. .. ..	Koleo.	Cardo.
Grass .. .. .. .. .. ..	Jöongorero.	
,, dry or dead; fuel .. .. .. .. ..	Wondongò.	
Hair-band .. .. .. .. .. ..	.. .. ..	
Hand .. .. .. .. .. ..	Nármli .. .. ..	Yarrmullah.
Hawk .. .. .. .. .. ..	.. .. ..	Tarnuni.
Kangaroo .. .. .. .. .. ..	Mínijillì (j French).	Karrakullah.
Laugh, to, <i>v.</i> .. .. .. .. ..	Jerung.	
Lie down, to, <i>v.</i> .. .. .. .. ..	Makkamadine.	
Mangrove seed .. .. .. .. ..	Keredì.	
Moon .. .. .. .. .. ..	.. .. ..	Jower.
Mouth .. .. .. .. .. ..	Dukarrah.	
Mussel .. .. .. .. .. ..		
My, mine; used sometimes interrogatively: as, Let that be mine? Is that mine? May I have it? .. .. .. .. ..	Darno.	
North .. .. .. .. .. ..	Koényah.	
Nose .. .. .. .. .. ..	Noomàloo .. .. ..	fremmalhui.
Opossum .. .. .. .. .. ..		Parrudine.
Pearl shells .. .. .. .. .. ..	Irèdzì .. .. ..	Egí.
Red ochre .. .. .. .. .. ..	Darboolhah.	
Red pea .. .. .. .. .. ..	.. .. ..	Gingalgworine.
Road or path .. .. .. .. .. ..	Margoorh.	
Sea .. .. .. .. .. ..	Narigolah.	
Sea egg ( <i>Echinus</i> ) .. .. .. .. ..	Gindel.	
Sleep, to, <i>v.</i> .. .. .. .. ..	Goolí.	
South .. .. .. .. .. ..	Barño.	

English.	Sea-coast Tribes.	Natives of the Interior.
Spear (for hunting)	Mangol.	Irakullah.
Sponge	Roogurro.	
Stars	Mungurah.	
Sun ..	Roomarrah.	
Tattooing	Markoodah.	
Thigh	Ballungerah.	
Throat	Yarmallah.	
Thumb	Kárrkorgá.	
Water	Woollah	Woollah.
West	Yalban.	
What is the name of it?	Nambomung .. ..	Nambo.
What is that?		Bungoon.
Woman	Banggoorh .. ..	
Zenith	Karliboh.	

By this it will be seen that the language ignores sibilant letters ; many of our consonants these natives cannot pronounce at all ; e. g. t, and its compound th, f, g, &c. In short, the language may be said to be composed chiefly of vowel and liquid sounds, with a limited number of consonants. The terminal h in many of the native words given above is very strongly marked, and is characteristic of and points prominently to the origin of the dialect. The letter r is rolled in the native pronunciation after the manner of the French.

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## XX.—*Land Journey Westward of the White Nile, from Abu Kuka to Gondokoro.* By J. PETHERICK, Esq., late H.B.M. Consul, Soudan.

*Read, April 25, 1864.*

[The following account of Mr. Petherick's land journey, with the exception of the tables of observations now printed for the first time, formed part of the Report which he furnished to the Society on the Speke and Grant Relief Expedition, and which was published, soon after it was read, in the 'Proceedings,' vol. viii. p. 126. It was then stated that the geographical results of the journey would be reprinted in the 'Journal,' accompanied by a map. The map, as will be seen, shows the connection between Mr. Petherick's land route and the explorations of all other travellers in this region, between the Ghazal on the north and Lake Albert Nyanza on the south. It has been compiled by Mr. Arrowsmith, after long and conscientious study of all available materials, including the well-kept field-books of Mr. Petherick and his assistant, Dr. Murie.

Mr. Petherick's original Report commenced with an account of his preparations and difficulties at Khartum. He left that place on his voyage southward, March 20th, 1862, passed the mouth of the Sobat on the 8th of April, and on the 17th reached the confluence of the Bahr-el-Ghazal. The season being very unfavourable, contrary winds and continued rains impeded his progress; and on the 2nd of July, having reached the station of the